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PRACTICAL STUDY

OF

DISEASES OF THE EYE.

A

GUIDE

TO THE PRACTICAL STUDY OF

DISEASES OF THE EYE:

WITH AN OUTLINE
OF THEIR MEDICAL AND OPERATIVE TREATMENT.

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BY

JAMES DIXON, F.R.C.S.,

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PREFACE.

In preparing for the press this Third Edition, I have by no means limited myself to a revision of my former volume. A considerable portion has been newly written, and the remainder rearranged and corrected.

The copious Table of Contents has been replaced by an Alphabetical Index. A few Notes, which do not pretend to be of practical interest, have been placed apart at the end of the volume, so that readers of a strictly practical turn need not be troubled with them.

I have endeavored steadily to keep in view the object with which I first undertook the work; namely, to supply a useful Guide to those commencing the study of Eye Diseases. In attempting this, I have chiefly described *outward* appearances, such as lie open to the view of the observer, and have said but little of those *subjective* symptoms which vary according to the peculiar susceptibility of individual patients.

Although I have very briefly touched upon the all-important subject of Treatment, I have attempted plainly and simply to record, in general terms, that which my own experience has led me to prefer. If I have criticized the practice of others, it has been only in a few instances, when

I felt it to be a duty to offer warnings against modes of treatment which I believed to be either useless or hurtful.

In the absence of colored plates, which, if executed as they ought to be, would have placed my volume beyond the reach of those for whom it is intended, I have given references to some of the best illustrated works published within the last few years. I would especially direct attention to the beautiful and correct drawings of LIEBREICH, which so faithfully exhibit the more important aspects of the deep tissues, as seen with the ophthalmoscope.

The truly encyclopædic work of MACKENZIE is so well known, that I need hardly mention it as containing an account of nearly all that has been written on the subject of Eye Disease, whether in this country or abroad, in ancient or in modern times. The French Edition, by WARLOMONT and TESTELIN, is not only a singularly faithful translation of the original, but is enriched with much additional matter; and a *Supplement* is now in course of publication, embracing those subjects which have been newly brought forward, or more fully investigated, since the publication of the *Treatise* itself.

PORTMAN SQUARE,
April, 1866.

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DISEASES OF THE EYE.

CHAPTER I.

OPTICAL DEFECTS.

REFRACTION AND ACCOMMODATION—EMMETROPIA—AMETROPIA—MYOPIA—HYPERMETROPIA—PRESBYOPIA—ASTIGMATISM.

Before commencing any description of those diseased conditions of the eye which are the result of inflammation or injury, it is desirable to consider the organ as an optical instrument, and to pass in review the chief defects of accommodation and refraction which cause deviations from the standard of healthy vision.

Since the last edition of this volume was printed, great attention has been paid to these defects, and several new terms have been introduced into ophthalmic nomenclature. Within the narrow bounds I have prescribed to myself, I can only in a very superficial manner treat of this most important subject, and for fuller information must refer my reader to some able works which have recently been published.*

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* Consult especially,—Donders On the Anomalies of Accommodation and Refraction of the Eye. Published by the New Sydenham Society, 1864. As introductory to this more elaborate treatise, the student may be recommended to read a smaller work by Mr. J. Z. Laurence, The Optical Defects of the Eye, 1865. A little work by

A healthy and well-formed eye, while in a state of rest, receives rays of light, and transmits them to the retina, just as we might imagine a model would do which had been so constructed as precisely to resemble the eye in respect of the refractive properties of its media. In either case, parallel rays, such as proceed from every *distant* object, would be brought to a focus upon the retina,—or upon the surface representing the retina,—and would there form a perfect picture of the object in an inverted position.

Light, however, which passes from a *near* object, does not fall upon the eye in parallel rays, but in divergent ones; and so long as the organ remained in a state of rest, these divergent rays would again converge toward a focus, not upon the retina, but behind it. For near vision, therefore, it becomes necessary that the refractive power of the eye should undergo such a change as will enable divergent rays from near objects to be brought to a focus on the retina; and this

It is still to some extent a disputed question how this accommodation is effected. It has been variously attributed to (1) an elongation of the entire eyeball in its antero-posterior diameter, and a consequent removal of the retina backwards; (2) to a special alteration in the curvature of the cornea; (3) to a forward movement of the whole lens;* (4) to an increase in its convexity.† The last explanation is that which appears most probable, and is now generally accepted as the true one. DONDERS expresses himself as entirely satisfied that this increase in the convexity of the lens is the cause of the accommodation of the eye to near objects. The experiments on this subject by CRAMER, made according to DONDERS's suggestions, are extremely delicate and difficult. They consist in noting the changes which the image of a flame reflected upon a patient's crystalline lens undergoes, while a near object is being observed by him.‡ If these experiments are proved to be free from all fallacy, the question of accommodation would seem to be finally settled.

Three of the above-mentioned theories of Accommodation are disposed of on the following grounds: (1) In cases where all the ocular muscles are inert, in consequence of paralysis of the third, fourth, and sixth nerves, the patient can still see near objects. (2) No mechanism can be suggested adequate to affect the form of the cornea, the curvature of which, also, during accommodation, has been tested by actual measurement. (3) Objections similar to those which relate to the change of form in the cornea are adduced in opposition to the theory of a movement of the whole lens, and also the fact that a mere alteration of position of the lens, unattended by any change in its form, would be inadequate to the end in view.

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* See Note A, at the end of the volume.

† This theory of Accommodation was first clearly maintained by Young in 1793 (see Note B, at the end of the volume). At a later period (1800), he described the experiments he had made on patients whose lenses had been removed by operation; he found that they had lost their power of accommodation. In this, however, he had been anticipated by Porterfield (see his Treatise on the Eye, &c., 1759, vol. i, p. 433); and even by Pemberton, Diss. Inaug., Lugd. Bat. 1719.

‡ Donders, op. cit.

In what manner the requisite changes in the form of the lens are effected is a difficult question to determine. That the iris is not of itself the active agent in accommodation is proved by the fact, that eyes devoid of any iris whatever still possess the power of adjustment to near objects.* At present the most received theory appears to be that which assumes the change of form in the lens during accommodation to depend upon the joint action of the iris and the ciliary muscle.[*]

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* I satisfied myself of this in a patient, the subject of *Irideremia*, whose case I published in 1858. (Ophthalmic Hospital Reports, vol. i, p. 54.) At the time she came under my notice considerable haziness of the corneæ, and isolated opacities of the lenses, had come on, so that I could not put her vision to any very accurate test. In 1859, Græfe had a favorable opportunity for making exact experiments, and the result convinced him that, in an eye from which he had himself accidentally removed the whole iris, accommodation was unimpaired.

DONDERS has not only greatly advanced Ophthalmology, by clearing up much of the confusion which formerly existed between defects of accommodation and defects of refraction, but has distinguished them by terms which have already become universally accepted.

An eye of perfectly normal refractive power, in which the parallel rays passing from objects meet in a focus *upon* the retina, he calls *Emmetropic*, "*Emmetropia*" implying *sight within due measure.*[†] An eye in which parallel, or insufficiently divergent, rays are brought to a focus *in front of* the retina would, on the same principle of terminology, be called "Hypometropic,"[‡] but DONDERS prefers to retain the term *Myopia*, partly for the practical reason that the word is established and universally understood, and partly because similarity of sound would be apt to cause confusion between *Hypo-* and *Hyper-metropia.*

---

[*] An interesting illustration of the dependence of accommodation on muscular action, is afforded by the temporary failure of accommodation which occurs in patients who have suffered from diphtheria. In them there is partial loss of power in the palatal muscles, as well as in that muscular tissue of the eye which acts upon the lens in adjustment to near objects.

[†] Ἔμμετρός, within measure, and ωπια, the terminal modification of ὤψ.

Donders uses the word "Ametropia" as a generic term to include all deviations from the normal standard of refraction. I cannot regard this word as happily chosen, for its sound so much resembles that of its opposite, Emmetropia, that in conversation the words are very apt to be mistaken. It seems to me that *Ecmetropia* would be a far better term as the converse of Emmetropia. We are already familiar with a pair of similarly contrasted words in Entropion and Ectropion. (See Note C, at end of volume.)

[‡] Ὑπομετρος, below the measure.

The cause of Myopia may either consist in the eye possessing a too great refractive power, or in its antero-posterior diameter being too long (Fig. 2); or both these conditions may be present. Parallel rays from a distant object come to a focus in front of the retina, and pass on to form upon it what are termed "circles of dispersion," which render the image of the object confused and ill-defined. By placing a concave glass of suitable curvature before the cornea, the parallel rays are made to diverge before entering the pupil, and are then reunited exactly upon the retina. (See Note D.)

*Hypermetropia** implies that condition in which the rays from distant objects tend to a focus *behind* the retina, while the divergent rays from near objects cannot be focussed upon the retina until they have been changed into convergent ones. In an eye so constructed the sight may be said to be "above the measure." Hypermetropia may depend upon the antero-posterior diameter of the globe being too short (Fig. 3), or its refractive power too low, or both causes may be combined. By placing a convex glass in front of the eye, parallel rays are made to converge, and they are then brought to a focus upon the retina.

---

* 'Υπέρμετρος, above the measure.

The following diagrams are given by Donders, as illustrating the three principal varieties of form in the human eyeball. Fig. 1 represents an Emmetropic, Fig. 2, a Myopic, and Fig. 3, a Hypermetropic globe. The contrasts are exaggerated,—purposely, no doubt,—and especially in respect of the relative form and size of the myopic eye.

FIG. 1.

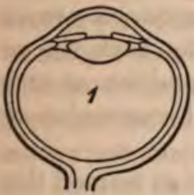


FIG. 2.

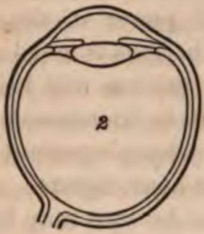
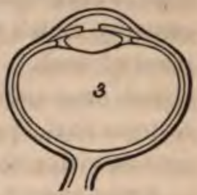


FIG. 3.



*Presbyopia.**—Great confusion has existed between the phenomena of Presbyopia and those of Hypermetropia. It is chiefly through the researches of Donders that the two affections have been clearly discriminated from each other. "Presbyopia," he says, "exists when, in consequence of the increase of years, with diminution of the range of accommodation, the nearest point has been removed too far from the eye." This recession of the nearest point of distinct vision is, Donders observes, a natural result of the changes that take place in the accommodative mechanism of the eye as age advances, and may therefore equally affect an eye that is emmetropic or one that is hypermetropic, and it is even compatible with myopia. It is Myopia and Hypermetropia, therefore, that stand as contrasts one to the other; not Myopia and Presbyopia.

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* Πρέσβυς, aged.

The cause of Presbyopia is supposed to be a gradual alteration in the structure of the lens, whereby it becomes firmer, and consequently less able to change its form during the efforts of accommodation. There may be also, at the same time, diminished power in the muscular apparatus by which the lens is acted upon. A convex glass of such a curve as will bring back the receded near point to its normal position, at once restores to the presbyopic patient his natural clearness of vision for near objects.

Astigmatism.[*]—An eye may be so formed that the rays of light which fall upon its transverse meridian, and those which fall upon its vertical meridian, become differently refracted, and consequently the rays entering the pupil cannot all meet at one and the same point or focus. The more frequent cause of this irregular refraction seems to be a want of symmetry in the cornea, its surface presenting different curvatures accordingly as it is measured vertically or transversely.

Young[†] appears to have been the first to ob-

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[*] From *α* and *στίγμα*, a point, implying that incident rays do not unite upon the retina at one point or focus. (See Note E.)

[†] In speaking of Young as having been the first to observe the asymmetry of the dioptric system of the eye, Donders (op. cit. p. 456) has inadvertently given a wrong reference. It is in Young's paper of 1800 (Ph. Trans. 1801) that the subject was first mentioned, not in that of 1793 (Ph. Trans. 1793).

serve this peculiarity, with which he was himself affected. He supposed the cause to be in his lens, which he imagined to be placed obliquely to the axis of vision. Subsequently, AIRY* published an account of this peculiar condition as existing in one of his own eyes. In a second paper on the subject he mentions that WHEWELL had suggested the term "Astigmatism" to designate the affection. AIRY constructed a glass of a peculiar form to correct the irregular refraction of his eye, and similar glasses are now in common use under the name of "cylindrical" or "astigmatic" glasses. The researches of DONDERS and others prove that astigmatism, at least in a slight form, is by no means uncommon. It is best detected by making the patient look at a page on which are drawn vertical and horizontal lines of equal thickness, and observing the difference of distance at which the two kinds of lines become accurately defined. The subject of astigmatism can correct the faulty refraction by placing in front of the eye a glass of such a form as will specially refract the rays falling on only one of the meridians of the cornea. Such a glass must be a segment of a cylinder, the axis of the cylinder being placed vertically, or transversely, or even obliquely, accordingly as the irregular refraction corresponds to these meridians. If he be myopic or hypermetropic, the glass must be concavo-cylindrical or convexo-cylindrical.*

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* The present Astronomer Royal. His first paper was communicated to the Cambridge Philosophical Society in 1825 (Transactions, ii, 257); his second paper in 1846. (Trans. viii, 361.)

The treatment of the various optical defects of the eye, hitherto briefly mentioned, consists in the use of glasses of such form as will correct the faulty refraction or accommodation.

Convex glasses give to the rays of light entering the hypermetropic eye an amount of convergence sufficient to bring them to a focus on the retina. Concave glasses cause the parallel rays emanating from distant objects to diverge, and the myopic eye, which is naturally adapted for focussing divergent rays, can then reunite them at one point on the retina.

Great inconvenience has arisen from the arbitrary manner in which opticians have been accustomed to designate their concave glasses. Convex ones have been always distinguished by numbers indicating in inches their focal length. Thus a convex glass of one inch focus was called No. 1, a glass of two inches focus No. 2, and so on. But this consistent rule was altogether disregarded in numbering concave glasses, and their increase of concavity was arbitrarily indicated by increasing high numbers. A more rational system is now being introduced, and a concave glass receives the same number as the convex glass which it neutralizes.†

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* Mr. J. Z. Laurence has invented an instrument for determining in an astigmatic eye the precise direction of the principal axis of asymmetry.

† Convex glasses are sometimes termed *positive*, and concave ones

In examining a patient's sight, it is manifest that definite and precise objects must be selected, and of these printing-types afford the best and most convenient form. As greater intercourse has been established between different countries, it has become more and more desirable that some uniform standard of the reading power of patients should be accepted, so as to enable isolated observers to understand the reports of each others' cases. But the sizes of printing-types are not the same in all parts of the world, and persons are usually unacquainted even with the typographical terms of their own country, unless they happen to have had some experience of authorship. When, therefore, E. JÆGER of Vienna, in 1854, published a series of typographical specimens, distinguishing the various sizes of the letters by numbers instead of the technical names, they were very generally accepted by the profession, and they are now usually referred to in reporting cases. More recently, SNELLEN of Utrecht has adopted a special form of type in which the strokes composing the letters are all drawn on a regularly proportioned scale of thickness.*

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negative, and are respectively distinguished by the common algebraical signs + and —.

* In arranging these types, he has acted on the following principle. If the eye be taken as a centre, and from it a circle be described of 12 inches in diameter, a well-illuminated object occupying one-sixtieth of a degree in this circle can be recognized. In other words, certain objects, the size of which is about the 600th part of an inch, can be seen at a distance of six inches. The smallest visual angle, however, which allows of the distinct perception of printing-types is about five minutes of a degree. On this datum Snellen has designed his tests.

To meet the difficulty presented by persons who have never learned to read, our own military authorities have adopted, as a test, printed dots of certain sizes, which the recruit is told to count, and describe the position of, at a definite distance. By a simple contrivance, the separate groups of variously-placed dots can be submitted to view one after the other.

Near and far points of distinct vision.—For every eye there is a certain distance at which small objects, such as types, are distinctly seen; and if these objects are brought nearer to the eye than the point indicated, they can no longer be recognized, even by the most short-sighted person. This is called the *near-point* of distinct vision. If the type be moved away from this point, it can still be read until it has receded to some more distant point, and the space between these two points comprises the patient's "range of accommodation."

In speaking of the *far-point* of a person's sight, the terms "finite" and "infinite" are frequently employed, and a beginner in optics may well be startled at finding that objects only a few yards

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Each one of his letters is uniformly drawn in lines the thickness of which is equal to one-fifth of the size of the whole letter; so that, while the letter occupies five minutes of the field of vision, each line composing the letter would occupy the space of only one minute. To each size of type Snellen adds a figure, indicating the number of feet at which the letters ought to be legible to an emmetropic eye. (See Test-types, &c., by H. Snellen, M.D., 1864, second edition. This edition contains some extra tables of "test-dots," such as have been adopted in the British army for determining the acuteness of vision in recruits.)

from him are spoken of as being "at an infinite distance." Taking the word "infinity" in its ordinary sense, it is manifest that no two objects can be at an infinite distance from each other. To assert the contrary would be to affirm an impossibility—endlessness between two ends. "Infinite," however, is the technical term for parallel or inappreciably divergent rays, whether coming from one of the heavenly bodies or from an object little more than twenty feet from the eye; while those rays which are appreciably divergent, as proceeding from an object nearer than twenty feet, are called "finite." In an emmetropic eye the far-point is said to be at an infinite distance; in myopia and hypermetropia at a finite distance, but under different conditions.

Having very briefly noticed the causes of *Myopia* and *Hypermetropia*, I may now make a few special remarks on their diagnosis and treatment.

In testing a case of myopia, we must not be led astray by the statements of patients, for they very commonly confound short sight with dim sight. In true, uncomplicated myopia, the minutest objects are often seen with extraordinary clearness and definition, and No. 1 of Jæger's type will be read off with the utmost ease at a distance of five inches, although at only double that distance it becomes wholly illegible. The rays proceeding from objects close to the eye are so divergent that they are brought to an exact focus on the myopic retina; but as soon as the object is removed beyond the patient's far-point of distinct vision, the rays, after coming to a focus anterior to the retina, again diverge, and form on the retina the "circles of dispersion" already alluded to. These circles become greater the farther the object is removed from the eye; and the partial closure of the lids, so characteristic of short-sighted persons, has for its object to diminish these "circles of dispersion," by cutting off some of the rays of light which would otherwise enter the pupil.

In very marked cases of myopia, the elongation of the antero-posterior diameter of the eyeball, alluded to at pp. 18, 19 (Fig. 2), may be recognized when the patient forcibly adducts or abducts the globe. The curve of the sclerotic is seen to be less abrupt than in an emmetropic or hypermetropic eye.

In examining a myopic patient with the ophthalmoscope, the vessels of the retina come into view as soon as the fundus is illuminated without the aid of the object-glass. They also appear considerably magnified.

But the most striking ophthalmoscopic appearance in a case of myopia is the *white patch* immediately adjoining the optic nerve. This is, I think, much too generally spoken of as "staphyloma posticum." No doubt cases occur in which there is a slight bulging of the sclerotic close to the spot where it is perforated by the optic nerve; but that any projection backwards worthy of the name of "staphyloma" exists, in the ordinary cases of myopia which exhibit the white patch, is, I am persuaded, an unfounded assumption. We are familiar with the term "staphyloma" as designating certain large outgrowths of the front of the eyeball, either resulting from destruction of the cornea and subsequent protrusion of the iris, with deposit on its surface, or from thinning and degeneration of the sclerotic, as in the well-known "staphyloma scleroticæ;" but no such marked protrusion of the sclerotic exists in ordinary cases of myopia. The white patch seems to be the result of an absorption of the pigmentous and other tissues of the choroid adjoining the optic nerve, which allows the whiteness of the sclerotic to be seen through the retina. At first this patch appears as a thin crescentic line, generally skirting the outer border of the optic nerve.* Afterwards it gradually enlarges, and surrounds the nerve more and more, so that, in elderly myopic persons, the nerve is often seen entirely encompassed by a broad white zone, the edges of which are frequently marked by fragments of dark pigment. I am not aware that attention has been drawn to the fact that no crescentic patch is seen in the eyes of myopic children. Indeed, it is rarely well marked before the age of twenty, even in highly myopic patients.

The degrees of myopia are so various, that no rule as to the near and far point of distinct vision can be laid down: each case must be judged of by itself. In extreme cases type is not read until brought within two inches of the cornea, or even closer than this, while in others, No. 1 of Jæger's tests can be easily read at five or six inches, or even farther off. An approximation to the degree of concavity required in a glass to enable a myopic eye to see distant objects is made by noting the greatest distance from the cornea at which a small type is read off with the naked eye, and then selecting a concave glass of the same focal length. A patient, for instance, who can read the small test-type at six inches, but no farther off, is said to be myopic to $\frac{1}{6}$, and he will require for distant objects a concave glass of about six inches focus (— 6″ according to modern notation). But various circumstances will influence this point, and the exact form of glass can only be determined by careful experiment. The special circumstances of the patient, and his amount of myopia, must be taken into consideration in determining what form of glass he should make use of. If myopia exists in only a slight degree, and the sight for near objects is acute, the occasional use of a pair of hand-glasses or of spectacles may be sufficient. A single glass should never be employed. In high degrees of myopia, in which reading can only be accomplished by holding the type within two or three inches of the cornea, spectacles must be constantly worn. Between those two extremes of simple myopia endless varieties occur, not to mention the very numerous instances in which myopia is complicated with other defects of vision.*

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* It therefore appears to the inner or nasal side of the nerve in the usual, indirect mode of ophthalmoscopic observation. For various kinds of the myopic patch see Liebreich's Atlas der Ophthalmoscopie. Tab. iii, figs. 1 and 3, show the more common forms. Fig. 3 shows very well the shreds of choroidal pigment fringing the patch See also an unnumbered plate in the first volume of Ophthalmic Hospital Reports, figs 4 and 5.

The usual cause of Hypermetropia (Fig. 3) is said to be insufficient length of the antero-posterior diameter of the globe, which causes the parallel and divergent rays entering the pupil to come to a focus behind the retina. Now the only natural rays of light are either parallel or divergent—convergent rays being produced by the artificial medium of convex lenses—and therefore, in high degrees of hypermetropia, neither near nor distant objects can be clearly and correctly seen. But the daily annoyance experienced by a patient in endeavoring to observe near and small objects is so much more obvious to him than the want of definition of distant ones, that he very commonly imagines his distant vision to be good, and consults the surgeon solely on account of difficulty in reading. In order to make the retinal image larger, he not unfrequently brings type near to the eye, and hence may be supposed by a superficial observer to be myopic. But even when the type is thus brought near, it cannot be read except with a constant effort, and for only a short time. In extreme cases of hypermetropia, reading is quite impossible. In fact the hypermetropic eye is constantly making the effort of accommodation; and it is this which causes any prolonged attempt to observe small objects to be accompanied by a painful sense of straining and fatigue.

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* For extended information on the use of spectacles in myopia consult the works of Donders, Wells, and Laurence, already cited.

The cure consists in the use of convex lenses. These give to parallel and divergent rays, before they enter the eye, such a degree of convergency as enables the patient to bring them to a focus on his retina. The focal length of the glass, necessary to accomplish this end, affords a designation for the degree of hypermetropia, and a patient, in whom small type is focussed on the retina by means of a glass of ten or fifteen inches focus, and who sees distant objects distinctly with one of thirty-five inches, is said to be "hypermetropic $\frac{1}{10}$, $\frac{1}{15}$, $\frac{1}{35}$," and so on.

Hypermetropia is so common an affection that its symptoms could not fail to have been noticed by former writers on eye diseases; and, accordingly, they are to be found described, with more or less accuracy, and more or less mixed up with other affections, under the very vague and unmeaning heading of "Impaired Vision."

In the first edition of the present work (1855), I noticed this subject of so-called "Impaired Vision," and pointed out the futility of treating the defect by external or internal medicines, and the relief to be obtained by the use of convex glasses. The researches of Donders have now placed on a true and scientific basis the treatment of an affection which was formerly either wholly maltreated or relieved empirically and without precise rules.

The treatment of hypermetropia by means of spectacles will vary according to the degree of the defect and the occupation of the patient.

Children must either be furnished with glasses of such convexity as will enable them to read continuously, or they will be deprived of nearly all the benefits of education. The spectacles may be used only for purposes of study, and at other times laid aside.* Hypermetropic persons who have to pass the greater part of the day in close application,—tailors, work-women, compositors, clerks, &c.,— may be obliged to wear them permanently, either always using the same focus, or having a stronger power for near objects, and a weaker one for distance, according to circumstances.

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* Donders insists much on the permanent wearing of spectacles in hypermetropia, as a means of curing the defect, by doing away with the necessity for over-exerting the effort of accommodation.

CHAPTER II.

EXAMINATION OF THE EYE.

SUPERFICIAL EXAMINATION.

The Conjunctiva and Cornea.—For examining the former of these structures, when attacked with the slighter forms of Ophthalmia, no special manipulations are required. The ocular portion is open to the surgeon's observation, and, to explore the lining of the lower lid, it is only necessary to depress the tarsus with the point of the finger. It is often difficult, however, to obtain a satisfactory view of the cornea in a child suffering from that irritable form of inflammation commonly known as *Scrofulous Ophthalmia*, but more correctly called *Keratitis.* The surgeon does but waste his time who attempts to coax or parley with such a patient. Light causes so much pain, that the child makes every effort to exclude it, by keeping the eyelids firmly pressed together, and even, in severe cases, thrusting his face against the pillow, or the dress of the attendant.

The surgeon should sit, and spread a folded towel across his knees. Opposite to him sits the attendant, who secures the child's hands, and lowers him backwards until his head is received between the surgeon's knees, and there firmly held. Thoroughly to expose the cornea without everting the lids requires tact, which practice alone can give. The extreme tip of the forefinger, with a bit of rag twisted over it to prevent slipping, having been laid upon the middle of the upper tarsus, at the very edge,—between the roots of the eyelashes and the globe,—the lid, without any dragging of the skin, is to be steadily pushed in a direction which, in the erect position of the body, would be upwards and backwards. In this way the greater part of the cornea is at once exposed; but if the finger is allowed to drag the skin of the lid, the tarsal cartilage becomes instantly tilted over, and the conjunctiva, bulging forwards, hides the eyeball from view. The lower lid may be depressed by a similar manœuvre; but this is not necessary in examining the cornea, for that part is always rolled upwards under cover of the upper lid.

If a more prolonged examination of the eyeball be required, as in a case of *Ophthalmia neonatorum*, a spring speculum must be employed, adapted, as regards width and strength of spring, to the small size of the palpebral fissure.

To expose the conjunctiva of the upper lid, the part must be everted, as if the surgeon were in search of a foreign body; and, indeed, it is with such an object that the eversion is most frequently performed. Whenever a patient complains of having had a fragment of anything blown into the eye, and a careful scrutiny of the edges of the tarsi, the fold of the lower lid, and the surface of the globe, has failed to reveal the cause of irritation, the upper lid should be treated in the following manner: A pen, the extreme feather end of which is cut off, so as to leave a stem just thick enough to resist bending, is laid across the upper lid, about half an inch from its free margin; then, while the finger and thumb of the other hand grasp the eyelashes growing from the middle of the lid, the pen is pressed a little downwards, at the same moment that the lid is drawn first a little forwards, and then upwards; the tarsus will suddenly tilt and fold over, so as to expose its conjunctival surface.

This manœuvre, simple as from description it seems to be, requires a good deal of *knack*. Both hands must act together, and if at the moment the turn is being given to the lid, the patient is told to look downwards, the eversion is much more readily accomplished. Minute foreign bodies, which have fixed themselves beneath the upper lid, are almost invariably found very near its tarsal margin; they should be lightly picked off with the feather or nib of the pen used for effecting the eversion. A pen is not only more convenient than a probe, but it has the advantage of appearing less formidable to a timid patient.

To those who are almost daily in the habit of thus everting the upper lid, and removing foreign bodies from its conjunctival surface, it is quite ludicrous to see what varied contrivances are from time to time suggested for superseding this simple feat. A bent probe covered with lint, or a wire twisted into the form of a hoe, and passed from side to side between the lid and the eyeball, are as unnecessary as the crabs' eyes that were introduced by the old oculists beneath the upper lid, in the hope that, by rolling about there, they might catch and expel the foreign body.*

Lens and Iris.—Great care is required in examining a patient in whom we have reason to suspect that Cataract is commencing. The first faint streaks of opacity in a lens will often escape detection, unless light be concentrated on the part by means of a convex glass of about an inch focus. I need hardly say that in all examinations of the eye, bright daylight is to be employed, not the direct rays of the sun. The observer must also take care that light does not fall upon the cornea from more than one window; and that reflections from mirrors and other polished surfaces do not interfere with the single ray of direct light which should fall on the part to be examined. No lens can be fully seen until the pupil has been widely dilated with atropine; but, inasmuch as this dilatation alters the visual focus of the eye, all particulars as to the patient's range and distinctness of vision should be noted before the atropine is applied.

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* It seems almost absurd to speak of the *inventor* of a manipulation which, one would think, must naturally have suggested itself to any person engaged in the practice of surgery; but, as far as I can discover, Ware was the first to describe the method of everting the upper lid. (Remarks on the Ophthalmy, &c., second edition, 1787, p. 23.) Beer, who was so long regarded, not only in Germany but in this country, as almost infallible in ophthalmic matters, while he devotes a whole chapter of elaborate trifling to the subject of foreign bodies, never once alludes to this simple plan of removing them, although he gives numerous rules for hunting after them with hair-pins, brushes dipped in butter, and similar droll contrivances.

The contractility of the iris is tested by placing the hand close to the eye for a second or two, and then quickly withdrawing it, so as to allow the light to fall suddenly upon the pupil, the other eye meantime being closed. The sympathy between the two eyes should next be examined, by observing how far light admitted to one eye influences the iris of the other.

It should be ever borne in mind that a dilated and inactive pupil by no means necessarily implies that the retina is diseased; nor an active pupil that the retina is sound. If one pupil be large and immovable, and the sight of that eye dim, the patient should be made to look at type through a large pin-hole in a card held close to the cornea. The object of this will be explained under the head "Mydriasis."

We must never be satisfied with a patient's vaguely telling us that he can or cannot *read;* we must have a precise and definite standard, such as is afforded by his reading to us aloud from type of several sizes. In hospital practice, those who have not learned their letters,—who, as they express it, "are no scholars,"—may be told count small dots, point out a single and a double line, or select an asterisk from other typographical marks. This subject has been more fully treated under the head of "Optical Defects." (Chap. I.)

The simple modes of examination hitherto mentioned have at all times been at the surgeon's command; I come now to consider the use of an apparatus—the *Ophthalmoscope*—the invention of which has enabled us to explore those deeply-seated structures previously altogether beyond the range of observation.

OPHTHALMOSCOPIC EXAMINATION.

The living retina was formerly assumed to be a transparent sheet of nervous matter, spread over a black ground—the choroid—and incapable of reflecting rays of light to the eye of an observer. CUMMING* was the first to demonstrate how readily the color of the living retina might be seen, if the observer did but look for it in the right way,—namely, by so placing himself that his eye should be, as nearly as possible, in the line of the rays of light falling on the retina of the patient. The investigations of CUMMING proved that the fundus of the living eye was not a dull black, but a light-colored, reflecting surface, and he was at once enabled to class among healthy phenomena certain colored appearances of the depths of the organ which from time to time had been noticed by different observers, and by them described as diseased conditions, under the various terms of "Cats'-eye amaurosis," "want of pigment," &c. CUMMING never obtained a view of the optic nerve, or the vessels of the retina; but his experiments prepared the way for the ophthalmoscope and all its invaluable revelations.

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* Medico-Chirurgical Transactions for 1846.

In 1851, HELMHOLTZ published an account of an ingenious polarizing apparatus, which would enable the observer to avail himself of artificial light in examining the retina, without intercepting with his own head any of the illuminating rays. Such interception had inevitably attended the simple experiments of CUMMING, in which the light was placed behind the observer. Several modifications of HELMHOLTZ'S apparatus were suggested.

In the following year, RUETE invented an ophthalmoscope on a principle wholly different from that of HELMHOLTZ; the light being thrown upon the patient's retina by means of a concave mirror, and the observer looking through a small hole in its centre. This leading principle of RUETE'S apparatus was adopted by COCCIUS, ANAGNOSTAKIS, and others, in their less complicated ophthalmoscopes, and has been adhered to in all subsequent modifications of the instrument.

The simplest form of the ophthalmoscope, as now employed, consists of a mirror, slightly concave, perforated in the centre, and fixed in a handle; and is either used alone, or with the addition of a convex or concave lens, according to the kind of image which it is intended to present to the eye of the observer.

The mirror of ANAGNOSTAKIS is of glass, with a focus of about 4 inches. That of LIEBREICH, which is perhaps the instrument now most generally employed, is of polished metal, with a focus of 4–6 inches. One of the advantages of the metallic mirror is, that the edge of the aperture can be made quite thin, whereas the glass mirror must be backed by a plate of metal, and by drilling through this, and through the thickness of the glass, the aperture really becomes a short tube. Any reflection from the wall of this tubular aperture must be prevented, by carefully covering it with a dead black coating. At the back of LIEBREICH'S instrument there is a little hinged clip for holding a convex or concave glass against the sight-hole. The concave glass is necessary in making an examination by the "direct" method, if the patient or the observer be myopic.

There are various forms of the ophthalmoscope which, in the hands of practised observers, will afford a good view of the fundus of the eye, but it is well for the student to begin with the simplest kind; those, for instance, which I have just mentioned. When habit has given dexterity in the combined management of the mirror and object-lens, the *binocular* ophthalmoscope, as invented by GIRAUD-TEULON, or some improved form of it, may be employed.*

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* Since the last edition of this volume was published, the literature of the ophthalmoscope has become so extensive as to embarrass the student in the choice of an instrument. Perhaps the most complete account of its various modifications is to be found in the German work of Zander, translated and condensed by Carter,—The Ophthalmoscope; its Varieties and its Use. 1864. But for those who simply require practical information for their own guidance, nothing

An ophthalmoscopic examination is made in a darkened room in the following manner:

The patient sits sideways against the edge of a table on which a lamp is placed, or at a convenient distance from a jet of gas, the flame being close to, and on a level with, his eye, but far enough back to prevent any light falling directly on his cornea. A glass shade faintly tinged with blue, by modifying the red rays, whitens the light, and imparts to the tissues of the eye a more natural appearance. When the binocular ophthalmoscope is used, the flame must be placed behind the patient, so that its rays may pass over his head.

Unless the pupil have become dilated by disease, it must be fully brought under the influence of atropine before the examination is begun. In many instances, however, a glance at the optic nerve and the parts immediately adjacent, is all that is required, and in that case it is unnecessary to subject the patient to the inconveniences of atropine.

The surgeon, sitting or standing close to and facing the patient, holds the mirror in front of the eye to be examined, at such a distance and in such a position as to concentrate the rays of light upon the patient's retina. As this cannot easily be done by a beginner, it is better for him to direct the rays at first upon the patient's cheek, or forehead, and as soon as a well-defined image of the flame has been formed there, a slight move-

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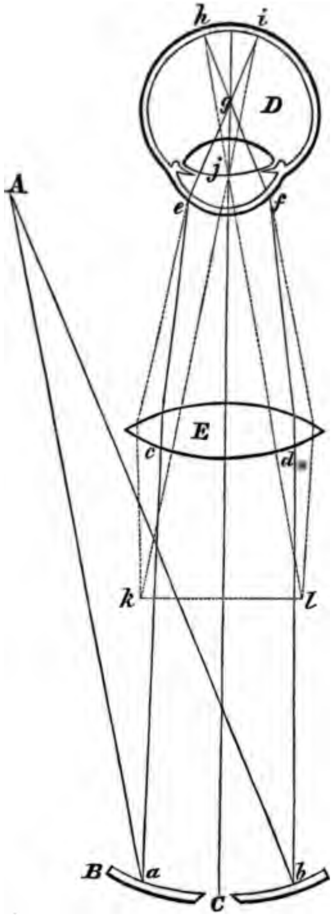
better can be recommended than the ably written work of Mr. Hulke, —A Practical Treatise on the Use of the Ophthalmoscope. 1861.

ment of the mirror will throw the rays through the pupil upon the retina itself. The fundus then presents a generally diffused, reddish glare, varying in different patients as to intensity of color; but in some cases the tint is, orange-red, orange-yellow, or even buff. When radiating bloodvessels can be seen, the proper position of the mirror has been attained.

If the patient turns the eye a little inwards, the optic nerve comes into view as a circular patch of white, faintly tinged with pink. From the centre of the nerve emerge the central artery and vein, both vessels dividing into several branches, which radiate towards the periphery of the retina.

There are two methods of examining with the ophthalmoscope,—the "direct," and the "indirect." In the former method, the mirror must be brought very close to the patient's eye,—an inch or two from the cornea, and the image of the retina then appears to the observer in its natural *erect* position. But this very close approximation to the patient is inconvenient; the side of the patient's head intercepts some of the light which ought to fall on the mirror; and only a limited portion of the retina, thus feebly illuminated, can be brought into view at one time. The direct method, therefore, is comparatively seldom employed, and chiefly for the purpose of examining in detail small portions of the fundus, which are seen in their true position, and considerably magnified.

In the "indirect" method, the mirror is held at a distance of several inches from the patient's eye, and a convex lens of short focus,—2-2½ inches—is placed a little in front of the cornea. In this way the inconvenient position of the observer and ob-



A is the illuminating flame; *B* the concave speculum; *C* the aperture in its centre; *D* the patient's eye, before which is held a convex lens, *E*. From the flame *A* the rays *a b* fall on the speculum, and are reflected from it towards *D*. Striking the lens, *E*, at *c* and *d*, they acquire a greater convergence in passing through it, and fall upon the cornea at *e* and *f*. Traversing the patient's eye, they again converge ,and, intersecting at *g*, form on the retina a "circle of dispersion" at *h i*. Reflected from the retina, in the direction of the dotted lines, *h*, *j*, *i*, *j*, they pass out of the eye, and being intercepted by the lens *E*, are again refracted, and form at *k l* an inverted image of the retinal surface *h i*, which is viewed by the observer's eye placed at *C*.

served is avoided; the retina is more brilliantly illuminated than in the "direct" method; and a good general view of the whole fundus is obtained. The image of the retina seen by the observer is an "aerial one," which is formed at a point between the convex lens and the ophthalmoscope, appearing there in an *inverted* position. This inversion of the parts examined must always be borne in mind by the student while employing the "indirect" method.*

The diagram on page 42, copied from ZANDER'S work, explains the mode in which the "aerial," inverted image is formed.

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* The observer is often annoyed by seeing a small bright image of the mirror he is using reflected from the surface of the object-lens. This image can be got rid of by giving to the lens a slight inclination.

CHAPTER III.

THE CONJUNCTIVA.

APPEARANCE OF THE CONJUNCTIVA IN HEALTH.

THIS varies greatly according to age, occupation, and climate. In infancy and childhood, the vessels are so small and few that, except at the inner and the outer canthus, there are hardly any visible to a casual observer; and the sclerotic has, in consequence, a uniformly white and glistening aspect. As age advances, the conjunctival vessels become larger and more noticeable, especially in persons much exposed to the weather; so that a considerable degree of redness of the conjunctiva may exist without constituting a disease.

In most people, after the middle period of life a yellow deposit occurs beneath the conjunctiva, and in anxious persons it often gives rise to a good deal of needless alarm. The situation in which this little growth appears, is on the equator of the eyeball, and close to, but never quite on, the inner and outer margins of the cornea, in the form of small yellowish-white elevations, around which there is usually a fine plexus of vessels. It is rare to meet with an old person in whom some slight deposit of this kind may not be discovered. If the surgeon be consulted on the subject, he may always reassure the patient as to the innocent nature of the growths. They never overstep the margin of the cornea, and need not in any way be interfered with. The term "pinguecula" has been applied to them.

DISEASES OF THE CONJUNCTIVA.

PTERYGIUM.*

This growth consists in a thickening of the conjunctiva and subjacent areolar tissue, with enlargement of the vessels of the part; it is hardly ever met with except at the inner side of the globe, where it assumes the form of a triangular reddish patch on the white of the eye; the base corresponding to the *plica semilunaris*, and the apex reaching to the edge of the cornea, or even a little way beyond it.

In a large pterygium, the sclerotic portion, when closely examined, resembles a delicate, thinly-expanded layer of muscle, intermixed with a few glistening aponeurotic fibres. The apex is obtusely rounded off, opaque and whitish in texture, and so firmly attached to the cornea as to look almost like an elevated, thickened cicatrix of that structure. It is this encroachment on the cornea that usually first alarms the patient; and he applies to the surgeon under the apprehension of "a skin growing over the sight." There is, however, little danger of this taking place, for the apex very rarely extends so far over the cornea as to obstruct the area of the pupil.

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* The best representation of a pterygium I am acquainted with, is that by Sichel, pl. xxvi, fig. 1. It is, however, rather exaggerated. Dalrymple's figures (figs. 2 and 3, pl. iii) are very indifferent.

Pterygium is of very slow formation, and gives rise to no pain or inconvenience. It is seldom met with, except in persons who have passed the middle period of life; but I have now and then seen it in younger men, sailors and others, who have spent much of their time in tropical climates.

It is useless to attempt the dispersion of the growth by any local application. Should the patient be very anxious to get rid of it, the surgeon may easily accomplish its removal by nipping it up with a forceps, about midway between the *plica semilunaris* and the edge of the cornea, and then dissecting this external portion from the sclerotic with a fine scalpel or cataract knife; taking special care, when removing the corneal part of the growth, not to injure the cornea itself. It is desirable not to cut away from the sclerotic more of the conjunctiva than has really become degenerated and unsightly; and it is seldom necessary to remove it quite up to the *plica semilunaris*. The operation is much facilitated by holding the lids apart with a spring speculum.

The varieties of pterygium, described by authors as *sarcomatous*, *fungous*, *malignant*, and *cancerous*, appear, for the most part, to have been growths of the ordinary kind, irritated and excited to overgrowth by repeated scarifications and the use of escharotics.

INFLAMMATION (*Ophthalmia*).

Although, according to strict etymology, the word *Ophthalmia* might be applied to any disease of the eye, it has, by common consent, been restricted to mean an *Inflammation of the Conjunctiva.*

This membrane, which in the healthy state allows the white sclerotic to be so distinctly seen through it that the two structures seem to form but one, exhibits, when inflamed, a red or "bloodshot" appearance.

According to the intensity of the inflammation, the redness may be either very faint in color, or of a uniformly deep tint. It may occupy the whole surface of the eyeball and lids, or may be limited to a small patch on the white of the eye; or, again, it may be confined to the lining of the lids, the eyeball retaining almost a healthy aspect. The student should familiarize himself with the different appearances which the injection of the vessels imparts to the eyeball, accordingly as the conjunctiva or the sclerotic is chiefly affected. In a severe case of the former kind, an attentive observer will notice that the redness is produced by an exceedingly close interlacement of vessels, which become finer, and anastomose more closely, as they approach the cornea. Large trunks may be traced from the inner and outer canthi, and indeed from every point on the line of junction between the lids and eyeball; and these trunks, as they converge towards the cornea, divide and subdivide until the naked eye can no longer follow nea

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and conjunctival inflammation, as these two forms of disease require different modes of treatment.

Writers on eye diseases have subdivided the Ophthalmiæ according to their supposed constitutional or external causes, the arrangement of bloodvessels in the conjunctiva, or the nature of its secretion. Thus we read of *Scrofulous* (or Strumous) Ophthalmia; *Pustular* Ophthalmia; *Purulent* Ophthalmia; and many others. The abundance of names adopted by some of the systematic German writers would appear incredible to those who have not examined their works. Many of these subdivisions are purely fanciful, and wholly inapplicable to practice. I shall endeavor to direct the student's attention to those forms only which possess marked and essential points of difference, both as to symptoms and treatment.

SIMPLE OPHTHALMIA.

(*Ophthalmia simplex—Conjunctivitis simplex.*)

Under the name of Simple Ophthalmia, some systematic writers describe an inflammation of the conjunctiva distinct from the catarrhal form, unattended with profuse purulent discharge, and not originating in rheumatism or scrofula. If, however, we exclude all these constitutional modifications, and also the irritation of foreign bodies and direct violence, nothing seems to be left which we can assign as the exciting cause of the so-called *simple* inflammation; or rather there will be no recognizable affection at all to which the term can be applied. Simple Ophthalmia and Catarrhal Ophthalmia, as described by Tyrrell, for instance, appear to be only different degrees of the same inflammation; and probably all cases of Ophthalmia termed *simple* are the result of those atmospheric causes in which the various forms of catarrh originate. The term Catarrhal, however, always suggests increased mucous discharge, and therefore we may naturally feel inclined to restrict the use of the word to that form of Ophthalmia which is attended with such increase and change of secretion; and to designate those slighter cases "simple" in which there is some degree of redness of the eyeball, without other remarkable phenomena. Mackenzie altogether discards the term *Simple* Ophthalmia.

It must be remembered, too, that true Catarrhal Ophthalmia, if seen soon after its commencement, does not present the phenomena which characterize its later stage; and thus the same case might in the eye, as if there were a foreign body, grit or sand, beneath the lid. The latter feeling is commonly caused by the over-distension of some vein, which projects above the smooth surface of the conjunctiva. It is impossible, however, to describe with any certainty the symptoms complained of by those suffering under the slighter forms of Ophthalmia; for the patient's account will vary according to his state of health, and the greater or less sensitiveness of his nervous system. Thus of two persons with the same amount of conjunctival redness, one will declare he has "no pain worth talking about," while the other describes his sufferings as severe—"agonizing." The. share which the condition of the nervous system has in modifying the characteristics of eye diseases, must constantly be borne in mind by the young practitioner, or he will be needlessly alarmed by the patient's description of symptoms. Not that the sufferings of the irritable, morbidly-sensitive patient are by any means to be dismissed as "imaginary." They are as real as the visible phenomena of the Ophthalmia; but they originate in a condition of the system which must be treated by general, rather than local, means.

The *treatment* of slight cases of Ophthalmia varies so much, according to age, habits, and constitution, that in a work like the present I can only sketch an outline of what ought to be done. First, ascertain what is faulty in the general health, the bowels, appetite, sleep, &c. In a plethoric, over-stimulated patient, restricted diet and purgatives will be as necessary as quinine and iron in a feeble and languid one, or opium and hyoscyamus in a third. A practised eye will catch at a glance the general aspect of the patient, and render but few questions necessary. Rest of the affected organ, moderate protection from light, occasionally the counter-irritation of a small blister on the temple, or, if there be much intolerance of light, the application of tincture of iodine to the skin of the upper lid, and the use of warm fomentations, simple or medicated, are the usual local means. The state of the patient's constitution, and, in some measure, his own feelings, will point out whether warm or cold applications should be preferred. In using stimulating lotions, it should be remembered that their use is not to be persevered in too long, otherwise they keep up, instead of subduing, the irritability of the conjunctiva; and it is well, after they have been used for a few days, to leave them off for a day or two, and observe the result. The application of fresh spermaceti ointment to the edges of the lids at night, is a comfort in nearly all cases of Ophthalmia, whether slight or severe.

PUSTULAR OPHTHALMIA.*

(*Aphthous Ophthalmia of* MORGAN.)

TYRRELL applies the term *pustule* to the more solid and vascular elevations, and *phlyctenula* to such as have fewer vessels, and rather resemble vesicles. MACKENZIE terms all elevations arising on the conjunctiva, "*pustules*," and restricts the term *phlyctenula* to those attacking the cornea in the disease commonly known as *Scrofulous Ophthalmia*, which he, therefore, also calls "Phlyctenular" Ophthalmia.

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* Figure 4, pl. xiii, of Dalrymple's work, shows Pustular Ophthalmia of the severer form. Such a case would probable be attended with intolerance of light, and other irritable symptoms, as the sclerotic appears to be involved in the inflammation.

The appearances in this form of conjunctival inflammation are so peculiar, that the student who has once seen a well-marked specimen, can never afterwards fail to recognize similar cases. On the white of the eye, a line or two from the edge of the cornea, and most commonly to its inner or outer side, little elevations—the so-called "pustules"—are seen, each surrounded by a plexus of vessels. There may be only one of these elevations, or several; and they vary in diameter from that of a fig-seed to that of a hemp-seed. They are vascular, but so much less so than the conjunctiva around their base that, by contrast, they frequently appear as if their summits actually contained pus; and hence they have obtained their name.* They are most common in children and young persons. When unattended with sclerotic inflammation, this limited form of Ophthalmia gives rise to little inconvenience; and a patient with several "pustules" dotted around the margin of the cornea, will frequently exhibit no intolerance of light.

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* Both Laurence and Mackenzie, while using the common word *pustular*, observe, that it is not strictly applicable to elevations which contain no pus. Perhaps "papular"—literally *pimply*—would be the most suitable term for this species of Ophthalmia.

Similar pustule-like elevations, however, sometimes accompany the irritable form of Ophthalmia denominated "Scrofulous," and in such cases the intolerance of light may be very marked; and whenever sclerotic inflammation is present, the same painful symptom is observed.

Independently of any medical means which the patient's general health may require, the true Pustular Ophthalmia commonly yields to very simple treatment. A weak tepid lotion of acetate of lead, twice or thrice a day, and, if there be any intolerance of light, a small blister to the temple, comprise all that is usually requisite.

CATARRHAL OPHTHALMIA.

Nearly all writers agree in using this term for that early stage of the disease in which the conjunctiva only is affected. If, at a later period, it chiefly confines itself to the sclerotic, it is termed by some *Rheumatic*—and, when both conjunctiva and sclerotic suffer equally, *Catarrho-rheumatic*—Ophthalmia. Should the inflammatory thickening of the conjunctiva go so far as to produce what is termed "Chemosis," and the discharge be profuse and puriform, it is difficult, by mere inspection, to distinguish the disease from Gonorrhœal Ophthalmia, and in this stage the disease is termed "Purulent Ophthalmia." Mackenzie gives the name "Puro-mucous Conjunctivitis" to a *genus*, of which the severe Catarrhal, the Purulent, the so-called Egyptian, and the Gonorrhœal, Ophthalmia, are *species.* Catarrhal Ophthalmia may exist alone, or in conjunction with other catarrhal symptoms. It usually begins with a reddening and swelling of the *caruncula* and *plica semilunaris;* and if the surgeon examines the lining membrane of the lower lid, its vessels will be found increased both in size and brightness of color. Next the ocular conjunctiva becomes inflamed, and in severe cases the fine network of vessels extends quite up to the edge of the cornea. Should the inflammation have involved the sclerotic, the characteristic pink zone will be traceable beneath that part of the conjunctival network which immediately surrounds the corneal margin.

A very characteristic sign of true Catarrhal Ophthalmia consists in minute extravasations of blood scattered over the inflamed conjunctival surface at different points. These blotches are sometimes not larger than a pin's head; at other times they run together, so as closely to resemble the effect that would be produced if a highly-finished colored drawing of conjunctival injection were slightly blotted here and there while the tint was still wet.

At this stage of the disease there is commonly not much increase of mucous discharge from the conjunctiva, but a slightly increased secretion of tears, and during the night the eyelashes become agglutinated. In persons of feeble circulation, some œdema of the lids commonly takes place.

Very little intolerance of light accompanies the purely conjunctival inflammation. The patient complains chiefly of a stiffness and weight in the lids, and a feeling of sand and grit between them and the globe—the effect of enlarged veins projecting above the natural level of the conjunctiva.

It is in this purely conjunctival form of Catarrhal Ophthalmia that the local application of nitrate of silver is of such remarkable utility. When the sclerotic is much injected, or there is any rheumatism present,—as evinced by the pink zone around the cornea, tenderness of the globe, pain about the orbit, and neuralgia throughout the ophthalmic branches of the fifth nerve,—the nitrate of silver is contra-indicated, at least until after the affection of the fibrous tissues has been subdued by appropriate treatment.

It is from a want of duly discriminating between the purely conjunctival form of Catarrhal Ophthalmia, and that in which the sclerotic and cornea are also affected, that many surgeons have been disappointed at the effect of the treatment by nitrate of silver. It is almost a specific in the former kind of inflammation, but commonly useless, or even injurious, in the other. The strength of the solution should be two grains to the ounce of distilled water; and two or three drops of this are to be let fall, from a large camel-hair pencil or clean quill, upon the surface of the eyeball, twice or thrice a day, the eye having been well bathed with warm water, and cleansed from all secretion, before the drops are applied.

By using the nitrate of silver in this manner, an attack of Catarrhal Ophthalmia is sometimes cut short within a week. Due attention must, of course, be paid to the state of the patient's general health; the bowels being kept open, and the diet regulated according to circumstances. As a rule, a moderately nourishing diet, and at least the accustomed quantity of beer or wine, are to be insisted on. But as, in a feeble and depressed subject, an additional quantity of stimulus will hasten the cure, just so must a reduced style of living be enforced upon the overfed and intemperate. The common sense of the surgeon must teach him to keep his patients on the proper level in these matters, and not to stuff or starve them indiscriminately, in accordance with any scientific theory.

In severe and obstinate cases of Catarrhal Ophthalmia, the injection of the ocular conjunctiva may gradually extend until all trace of distinct vessels is lost; the whole membrane assuming a thickened, velvety appearance, quite up to the margin of the cornea; or the subconjunctival areolar tissue may become infiltrated with serum, giving rise to the condition termed *Chemosis*, in which the conjunctiva is raised up from the sclerotic, and presents an uneven surface, somewhat like the watery granulations of an indolent ulcer of the skin. In this stage of Catarrhal Ophthalmia the mucous discharge from the inflamed membrane is sometimes considerable, loading the eyelashes, and gluing them together in the morn-

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PURULENT OPHTHALMIA.

This disease has received various names, according to the nature of its *secretion* (Ophthalmo-blennorrhœa; Conjunctivitis puro-mucosa; Suppurative Ophthalmia); its *contagiousness* (Ophthalmia contagiosa, MACKENZIE); or from the *persons who are chiefly liable to it* (Egyptian Ophthalmia; Ophthalmia bellica; Military Ophthalmia).*

From what I have just said respecting Catarrhal Ophthalmia, the reader will readily perceive how impossible it is to make any definite practical distinction between it and Purulent Ophthalmia, inasmuch as a severe case of the former and a mild case of the latter offer precisely the same phenomena. The difference between the two diseases appears to be one simply of degree, unless we consider contagiousness to be a distinctive mark of the purulent affection.

If seen, then, at the first onset, a case of Purulent Ophthalmia resembles one of ordinary Catarrhal Inflammation, but it proceeds so rapidly, that twenty-four hours are sometimes sufficient to furnish the peculiar signs of the more serious disease,—the swollen lids, chemosis, and haziness of the cornea.

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* The literature of Purulent Ophthalmia is most extensive. From its prevalence in armies, and other large bodies of men, it has specially attracted the notice of military surgeons: it has formed the subject of several prize essays; and the most celebrated Ophthalmic surgeons of Europe have, at various times, published reports of its ravages among the troops of England, France, Prussia, Austria, Russia, and Belgium.

It is the last-named structure that should chiefly engage the surgeon's anxiety; for, unlike the common Catarrhal Ophthalmia, which limits itself to the comparatively unimportant conjunctiva, the *purulent* form rapidly endangers sight, by involving the cornea in its ravages.

In a well-marked case of Purulent Ophthalmia, the patient is usually pallid, and both physically and morally depressed. The eyelashes are loaded with yellow discharge; the lids are swollen and dusky red, and so infiltrated that the patient cannot separate them sufficiently to expose the cornea. This inability naturally suggests to him the notion that he is literally *blind;* and it is sometimes important, as a means of raising his spirits, for the surgeon at once to expose the cornea, and convince him that sight is still retained. The conjunctiva is everywhere reddened, infiltrated, and elevated above the level of the cornea, producing the appearance termed *Chemosis*, but usually looking more solid, and less watery, than in common Catarrhal Ophthalmia. If this chemosis has proceeded to its fullest extent, it overlaps and completely hides the margin of the cornea, and it may even protrude a little between the lids. The cornea, being overspread with thickened secretion, often appears, at first sight, to be really opaque or hazy; and the surgeon must take pains carefully to wipe away this secretion before pronouncing a positive opinion as to the state of the cornea beneath it. But even then he can only speak very guardedly; for the ulceration, which in this disease is so destructive, frequently begins at the extreme edge of the cornea, the very part hidden, as I have said, by the overlapping of the chemosis: and it may thus escape detection until it has perforated the entire thickness of the cornea, and caused prolapsus of the iris.

In very severe cases of Purulent Ophthalmia, this ulceration rapidly advances in the form of a crescentic groove, becoming deeper and wider until it has isolated the central part of the cornea, which by that time has assumed a hazy or even opaque appearance. Then this central portion likewise yields to ulceration at one or more points, becomes softened, sloughy, and infiltrated with pus; it gives way, the iris bulges through the large opening thus formed, and, eventually, becoming coated with fibrous exudation, assumes the prominent appearance known as *Staphyloma.*

The ulceration may stop short of actual perforation, after destroying a large portion of the anterior surface of the cornea, and in such cases the cicatrices formed by the healing of the ulcers remain ever afterwards white and opaque; while the rest of the cornea, in consequence of inflammatory deposit and infiltration of pus, never regains its healthy transparency, but at best becomes sufficiently translucent to allow a dim view of the iris, not, however, affording the patient any useful sight. Those attending the practice of our Eye Infirmaries must be familiar with the aspect of patients whose corneæ have undergone some of the changes I have been describing. Soldiers who have suffered from severe Purulent Ophthalmia, in India or some of the colonies, exhibit the most distressing ravages of this disease.

Another result of the inflammation of Purulent Ophthalmia is *slough of the cornea*. The chemosis having increased, so as to overlap not only the extreme margin, but the greater part of the anterior face of the cornea, the latter loses its transparency, becoming at first milky, then yellowish, and quite dull on the surface, and finally flabby and perfectly opaque, like a piece of wetted wash-leather. At this stage the chemosis diminishes, the profuse purulent discharge ceases, and is succeeded by a flow of tears, rendered slightly turbid by a small quantity of mucus, and the patient and those about him are often pleased at the apparent improvement, and flatter themselves with hopes of a speedy recovery, at the very moment when the surgeon knows but too well that sight is lost forever. Still, as long as any portion of either cornea retains its vitality, the case must not be abandoned in despair; for if only a small portion, less even than a quarter of one cornea, can be saved from destruction, and its transparency retained, useful sight may eventually be gained by the operation of making an Artificial Pupil.

It was to obviate, if possible, this sloughing of the cornea, that TYRRELL devised, and so warmly advocated, the plan of making radiating incisions through the chemosed conjunctiva. He believed that the swelling of this membrane caused such tension and pressure on the vessels supplying the cornea as arrested the flow of blood, and so induced death of the part. But the operation was based on an anatomical mistake—namely, that the cornea is wholly nourished by vessels prolonged into it from the conjunctiva. Mr. T. W. JONES, in a letter published in the Medical Gazette,* exposed the fallacy of this theory; and subsequent experience has, I think, decided that these radiating incisions by no means insure the happy result the inventor of the plan so confidently anticipated. I have frequently tried them, but could never satisfy myself of their contributing towards the cure of the disease.†

Two precisely opposite modes of treatment have been adopted in Purulent Ophthalmia—the *depletory* and the *stimulating.* The first was carried to its fullest extent in the various armies of Europe during the late war, and has since been advocated by eminent authorities in civil practice.‡

The opinions of the profession on the subject of inflammation and bloodletting have of late years undergone such a total change, that I need hardly caution the reader against attempting to cure Acute Purulent, or Gonorrhœal Ophthalmia, on the principle so strongly urged, less than thirty years ago, by one of our most distinguished writers on Eye Diseases, who, in reviewing a case of Gonorrhœal Ophthalmia, which *had been seen at a very early period of the complaint*, and treated by large bleedings, both local and general, records his opinion as follows: "From the unfortunate termination of this case, ... I infer, not that antiphlogistic treatment is incapable of arresting this inflammation, but that it had not been carried to a sufficient extent; and if I had to treat some of these cases again, I should certainly bleed *more freely*."* "As much blood should be taken from the arm as will flow from the vein, and the evacuation should be repeated as soon as the state of the circulation will allow us to get more." This practice is enforced by the following quotation from Bacot's Treatise on Syphilis: "These are cases which defy all the usual etiquette of regular and ceremonious visits. If we wish to save our patient from the destruction of his vision, we must scarcely depart from his bedside until the inflammatory symptoms are controlled. The lancet must be hardly ever out of our reach, for if ever there was a disease in which blood may be taken away without limitation, it is this." Mr. WARDROP'S statement is still more startling: "The only case [of Gonorrhœal Ophthalmia] he had seen, in which the eye was saved, was that of a young woman, in whom venesection was repeated as often as blood could be got from the arm. She lost 170 ounces in a few days, and looked as if every drop of blood had been drained from her body; the skin having nearly the hue of a wax candle."

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* Vol. I. New series, 1839.

† For a full account of this plan, see Tyrrell, vol. i, pp. 72-94.

‡ The 12th chapter of Mackenzie's Treatise, &c., gives a very ample critical account of the history of Purulent Ophthalmia, as observed on a large scale by various military surgeons of repute, and enforces the advantages to be derived from a plan of treatment the very reverse of that by depletion, which they almost uniformly pursued.

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* The patient, a young man, aged 24, had on the first day been bled to fainting; then vomiting was kept up by tartar emetic as long as it could be borne. In the evening "the pain in the eye had become worse." He was bled again. On the following morning the swelling of the lids was greatly increased, so that the eye could not be seen, and there was copious yellow discharge; the night had been passed in severe pain, which entirely prevented sleep. Bleeding was repeated twice more; blood was taken, by cupping, from the back of the neck and the temple, and leeches were applied round the eye in large numbers; "but *although* the free use of purgatives and antimonials, with low diet, was combined with these measures, no sensible effect was produced in diminishing the violence of the inflammation, or arresting its progress."

Can we wonder that thousands of persons, with that tendency to rush into extremes which is one of the infirmities of our nature, should seek refuge from such treatment under the milder discipline of Homœopathy?

If the treatment of Purulent Ophthalmia by excessive depletion be judged by its results—the only sure test—we shall, I think, be forced to confess that there was ample cause for trying some less violent means of cure. As far as my own experience at a large metropolitan hospital enables me to form an opinion as to the general condition of patients suffering under Purulent Ophthalmia, I should say that they are uniformly more or less depressed, with a pulse more feeble than natural, and in a state which in every way contra-indicates bleeding, and calls for the administration of tonics. There is usually a coated tongue, with loss of appetite, and a purgative is needed at the very outset of the treatment. Afterwards, either bark and ammonia, or quinine, should be given, and hyoscyamus if the patient be restless. Pure air—the best of all tonics—must, if possible, be obtained; and all unnecessary confinement to bed, or to one room, avoided. Meat may be allowed daily, and a moderate quantity of beer or wine; but on this head no arbitrary rule can be laid down. The surgeon's judgment must guide him as to the cases in which he ought to forbid stimulants, recommend them in moderation, or even insist upon an extra quantity being taken.

Meantime, the local treatment should be commenced at once. I always employ either a solution of alum (eight or ten grains to the ounce of distilled water), to be injected under the lids every quarter of an hour, or nitrate of silver (three or four grains to the ounce), to be applied three times a day. It is useful, after employing the nitrate of silver for a few days, to change it for the alum, or *vice versâ*. The application of the solid nitrate of silver to the whole surface of the inflamed conjunctiva is preferred by some surgeons, but I have not found it superior to the solution above mentioned. In those cases (chiefly occurring, however, in *Gonorrhœal* Ophthalmia) where rapid ulceration is beginning at the margin of the cornea, a fine point of nitrate of silver may be passed over the whole surface of the ulcer.

The student ought constantly to bear in mind that, although the disease termed Purulent Ophthalmia has received its name from that symptom which most readily attracts notice—namely, the profuse conjunctival discharge—the real source of danger lies in the *cornea;* and that, even if it were possible, by draining the patient of blood, materially to lessen, or even wholly arrest, the discharge, we might still fail to save the eye. It is not the flow of pus or mucus, however abundant, that should make us anxious, but the uncertainty as to whether the vitality of the cornea be sufficient to resist the changes which threaten its transparency.

These changes are twofold—*rapid ulceration*, and *sloughing*. Now, has any sound surgeon, I would ask, ever recommended excessive general bleeding and salivation as a means of averting these morbid changes from any other part of the body except the eye? And why are all the principles which guide our treatment of disease in other organs to be thrown aside as soon as it attacks the organ of vision?

Do what we may, it must sometimes happen that, in the more acute cases of Purulent Ophthalmia, our best endeavors are in vain, and the cornea becomes irreparably damaged; still I feel convinced that, if we are unremittingly watchful to observe the changes which take place in the eye itself or in the general health of the patient, and to modify our treatment accordingly, a tonic and stimulating plan, such as I have sketched, will do all that our present knowledge of the disease can enable us to accomplish.

GRANULAR CONJUNCTIVA.

(*Granular Lids.*)

After Purulent Ophthalmia, and long-continued Catarrhal Ophthalmia of a severe character, the palpebral conjunctiva assumes a reddened and uneven appearance, somewhat resembling, in the more strongly marked cases, the surface of a granulating ulcer. It must not be supposed, however, that the conjunctiva is really overspread with *granulations*, in the true sense of the word; otherwise we should find various portions of the membrane uniting together, like the opposed surfaces of a granulating wound. The so-called "granulations" are merely the mucous follicles and papillæ of the membrane, enlarged by inflammatory deposits.

When these "granulations" are hard, and attain considerable size, they act very much as foreign bodies would do in a similar situation, producing constant irritability and blinking of the lids; increased flow of tears mixed with mucus; and opacity of the cornea with enlargement of its veins; and, in cases of old standing, these veins form a network overspreading the entire surface of the hazy cornea.

For removing these irregularities of the conjunctiva, various plans are in use: complete excision with the knife or scissors; destruction by means of escharotics, or a more gradual wasting by the astringent effect of drops and lotions. Dusting over with acetate of lead in fine powder has been strongly recommended.

I believe that in most cases of granular lid our chief dependence must be placed in improving the patient's general health, by giving him iron and quinine, singly or in combination, regulating his diet, and, if possible, placing him in a pure and bracing air. A small seton in the skin of the temple, kept open with a single thread, and occasionally stimulated, if the discharge becomes scanty, with some caustic or other irritant, is a slow, but often very serviceable, adjunct. Tincture of iodine, painted on the skin of the lids, is also useful.

I have, at various times, tried all the most approved lotions and drops, but have never satisfied myself that any of them were of much benefit. The acetate of lead in fine powder, dusted over the everted lid, produces considerable pain at the time of its application, but afterwards gives decided relief, apparently by mechanically filling up the interstices of the "granulations," and so producing a smoother surface for the eyeball to move upon. As the salt slowly dissolves, it probably exerts also an astringent effect upon the vessels supplying the enlarged follicles and papillæ, and so diminishes the size of these excrescences.

I have seen much benefit from applying the undiluted Liquor Potassæ to the palpebral granulations. Dr. BADER, I believe, first suggested this plan of local treatment, and certainly it is the most successful I have yet tried. The fluid is dabbed upon the everted lids, so as to be thoroughly brought into contact with the whole surface, and it appears to act by saponifying and dissolving away the hypertrophied tissue. It may be applied at intervals of a few days; and in some cases I have seen the granulations removed, and much of the original clearness of the cornea restored, in the course of six weeks.

Any person who has attended the practice of our London Eye Infirmaries, must have been struck with the fact that the severer cases of Granular Lids, with the attendant deformity of Entropion and misplaced eyelashes, are met with among the more destitute Irish patients; and from competent medical testimony it appears that a very severe form of Purulent Ophthalmia is sometimes epidemic in certain districts of Ireland, where it rivals in intensity that which has been observed in Egypt and India. WILDE published an interesting paper on this subject in the London Journal of Medical Science (vol. iii, 1851); but so long ago as 1803 it was remarked by POWER, in a pamphlet on the Egyptian Ophthalmia, that a species of the same disease was "frequently prevalent among the Irish peasantry, and considered by them to be infectious."

Inoculation.—We meet with certain cases in which, although the granular condition of the lids has been got rid of, and the patient's general health is restored, the cornea still remains opaque and traversed throughout by large bloodvessels. Vision is limited to mere perception of light, and yet there may be every reason for believing that behind the cornea the tissues of the eye are healthy.

mode of treatment by inoculation is unsuitable in cases of old ulceration of the cornea.

GONORRHŒAL OPHTHALMIA.

This disease presents all the phenomena of Purulent Ophthalmia, but in a more severe and rapidly destructive form. It is, in fact, Purulent Ophthalmia caused by the specific secretion of gonorrhœa coming into contact with the conjunctiva.

If seen quite at the beginning, there is nothing to distinguish this Ophthalmia from the ordinary Catarrhal form. There is similar conjunctival injection, and increased mucous discharge, and the patient complains of a feeling as if sand were under the lids.

The inflammatory symptoms, however, come on so rapidly in a truly gonorrhœal case, that a few hours sometimes suffice to develop all the more serious phenomena; such as *chemosis*, redness and swelling of the lids, profuse puriform discharge, and even general haziness of the cornea.

It is stated by some writers, that Gonorrhœal Ophthalmia usually attacks one eye only, while the non-specific purulent form attacks both eyes together. This assertion, however, is incorrect. I do not remember to have seen a well-marked case of Gonorrhœal Ophthalmia in which both eyes were not affected, although it is certainly true that very commonly an interval of two or three days elapses before the second eye is attacked; and even then the disease is often much milder in one eye than in the other.

Among the more ignorant classes, Gonorrhœal Ophthalmia is sometimes the result of a very prevalent vulgar error,—that it is a sovereign remedy for sore eyes to bathe them in the patient's own urine. In this way the complaint originated in a patient who came under my care some years ago, at the London Ophthalmic Hospital.

I will here relate his case, as it affords a good opportunity for describing the appearances presented by the acute form of the disease.

He was a bricklayer, aged twenty-four, of dissolute habits, and had squandered, in all kinds of debauchery, a small sum of money which had been left him. From Christmas, 1849, till the time I saw him, he was frequently out of work, eating little meat, but drinking immoderately whenever he could obtain the means of doing so, —"sometimes three or four quarterns of gin, and six pots of beer, in the course of a day."

At the beginning of March, 1850, he caught a gonorrhœa, for which he became an out-patient at a general hospital. While under treatment there, he almost wholly abstained from liquor, taking only a pint of beer now and then; on some days none at all. During the 12th and 13th of March, after having been exposed to much dust while engaged in pulling down some old houses, his eyes for the first time "felt weak;" but there was no discharge from them. By the advice of his mother-in-law (who, naturally enough, knew nothing of his gonorrhœa), he bathed his eyes in his own urine on the morning of the 14th, and again the day following; and on the evening of the 15th a discharge from the eyes began. On going to bed he applied a poultice to the left eye: this, as might be supposed, only increased the mischief; and as the discharge become more profuse, he came on the 18th to the hospital. There was then a slight puriform discharge from the right eye, but no chemosis; merely a moderate degree of conjunctival injection. The cornea was quite clear. In the left eye the chemosis was so great as to overlap and hide the margin of the cornea. The elevated conjunctiva had not the rough, fleshy appearance it so often presents, but was smooth on its surface, evidently raised up by a large quantity of serum, and dotted over at various points with little patches of extravasated blood. The lids were only slightly swollen, but of a livid, dusky-red tint; and the eyelashes were loaded with profuse yellow secretion. The iris acted naturally.

On casual observation, the cornea appeared hardly affected, so nearly had it retained its natural clearness and polish; but, on a more careful view, a large deep ulcer was seen occupying its lower third. The surface of the ulcer, and its sharply-cut upper edge, were so transparent that, except when the light fell exactly on the part, the loss of substance could not be appreciated.

The patient was very pale and thin; extremely depressed in spirits at the prospect of losing his sight; and much prostrated by the sudden deprivation of the artificial stimulus to which he had so long been accustomed. His pulse was feeble, and his appetite bad; his bowels had been freely acted on. He was taken at once into the hospital; and I ordered him three grains of disulphate of quina every six hours, a mutton chop for dinner, and a pint of porter. Alum lotion (ten grains to the ounce) was to be injected under the lids every quarter of an hour.

On the 19th, the patient's pulse was unimproved, and his depression extreme. The ulcer had spread. The conjunctiva of the right eye was more injected, and the cornea looked a little hazy. I ordered him a second pint of beer, to be taken with his supper, and four ounces of port wine in the course of the day; a solution of nitrate of silver (five grains to the ounce) to be dropped once into the left eye, and then the alum injection to be resumed.

On the 21st, the ulceration had spread all round the margin of the left cornea, leaving only the central third of its anterior surface intact. Two days later, the right eye was considerably improved; the discharge being much less, and the cornea almost clear; but the ulceration in the left had steadily advanced, so as to have reduced the central, unbroken portion of the cornea to a very small patch, which was cloudy, and evidently in a hopeless state. The patient's general condition, however, was improving; the arrest of disease in the right eye had made him cheerful, by taking away the dread of total blindness which had previously oppressed him. His pulse was fuller, and he slept well.

24th. The small central patch of cornea still remaining unbroken was to-day in a state of slough, as was also the thin layer of the peripheral portion—apparently the "posterior elastic lamina" —which had hitherto remained undestroyed, and still prevented the escape of the aqueous humor. The discharge from this eye had now almost ceased. That from the right was very trifling, and its cornea perfectly clear; the conjunctiva still retaining a reddened, velvety appearance. A solution of nitrate of silver (two grains to the ounce) was ordered to be dropped thrice a day into each eye, instead of the alum lotion.

26th. The dead cornea had come entirely away from the left eye, leaving the iris bare, or at least only thinly covered by a transparent glaze of apparently recent lymph. The pupil was of a clear black, and, except that the iris was anteriorly convex, a superficial observer might have supposed the cornea to be still *in situ* and transparent. Discharge had now ceased from both eyes, and the conjunctival vascularity was rapidly diminishing.* On the 28th, the left iris began to be overspread with an opaque film, and was gradually hidden from view as the adhesive deposit became more and more consolidated.

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* On the 26th, the right knee was attacked with rheumatism, and the day following the left one also. This disease of joints has been frequently noticed as a sequela of gonorrhœa.

I have given the chief details of this case, omitting many of less importance, because, as I have said, it affords a good example of severe Gonorrhœal Ophthalmia, and especially illustrates the process by which, I believe, the destruction of the cornea is almost always effected—namely, by deep ulceration beginning along its margin, and advancing in the form of a crescentic groove, until it has isolated the central portion, which, being deprived of its supply of nutritive material, becomes opaque, dies, and is cast off as a slough.

If my object had been simply to bring forward an instance of Gonorrhœal Ophthalmia successfully treated, I might have made my selection from a considerable number of cases in my notebooks, and might have illustrated the good results which sometimes follow the early application of the solid nitrate of silver to the commencing ulcer of the cornea. But for my present purpose, a case such as I have related seems more useful.

The advocates of excessive bleeding and depletion may point to the case as illustrating the failure of an opposite treatment, and suggest that a strictly depletory plan might have saved the left eye. My firm belief is that it would inevitably have caused the loss of the right one also; and that in such a subject, exhausted by former excesses, pale, emaciated, and depressed, and with ulceration of the cornea already so far advanced, it was unreasonable to expect more than that one eye should be saved from destruction.

PURULENT OPHTHALMIA OF INFANTS.

(*Ophthalmia neonatorum.*)

The student must ever bear in mind that in this Ophthalmia, just as in the Purulent Ophthalmia of adults, it is upon the degree to which the *cornea* is involved that the whole importance of the disease depends; and his chief attention, when an infant is first examined, should be fixed on the clearness or opacity of that structure, and not on the more obvious appearances of redness, swelling, and purulent discharge which the *eyelids* present.

Various theories of the origin of this Ophthalmia have been suggested; some regarding it as a mere catarrhal affection; some as due to actual contact with the leucorrhœal discharge of the mother in parturition; while others attribute it to irritating substances applied soon after birth; or to other causes. It seems probable that the marked difference of symptoms observed in infants suffering from this disease, is due to the exciting cause not being in all instances the same; and that, as in adults, we meet with purulent discharge from the conjunctiva in Simple Catarrhal, in the "Purulent," specially so called, and in the most severe, or Gonorrhœal, Ophthalmia, just so do the milder cases of the disease now under consideration arise from exposure to draughts of cold air, and sudden changes of temperature; while contact with leucorrhœal or gonorrhœal matter may give origin to those severe cases, in which rapidly destructive ulceration of the cornea dooms the unhappy child to life-long blindness.

In a case of *Ophthalmia neonatorum*, the surgeon is so deeply interested in forming an accurate diagnosis, both to satisfy the parents and to preserve his own reputation, that he should spare no pains to ascertain the precise condition of the cornea. For this purpose, having properly secured the child's head in the manner described in Chapter II, he should endeavor carefully to separate the lids without everting them. This is often extremely difficult, especially when the palpebral opening is unnaturally small, and the lids offer but a very small surface to the point of the finger. A wire speculum, of a size and strength of spring proportioned to the small palpebral opening, will always overcome the difficulty. With a bit of moistened lint, the creamy matter, which oozes out as soon as the lids are drawn apart, is to be wiped away; and the surface of the cornea thoroughly examined. Occasionally it will happen, especially if a strong astringent lotion has been dropped into the eye, without any regular cleansing with the syringe or otherwise, that some of the secretion becomes coagulated, and is found overlying the cornea, like a piece of wetted wash-leather, resembling very closely the appearance of a sloughy cornea. I have sometimes had to remove with a forceps such a layer of solidified secretion (which, on hasty inspection, might have been mistaken for a slough), and have found the cornea itself sound and clear.

The conjunctiva of the lids is always red and villous. The secretion varies much, both as to quantity and color. It has a deep yellow tinge, if the child be jaundiced. The lids are red and swollen during the acute stage of the severer form of inflammation; but they commonly become flabby, and lose their redness, when softening and ulceration of the cornea are fully set in.

The disease, as may readily be supposed, attacks both eyes, although an interval of a day or two, or even more, may elapse before the second eye suffers. I met with a case which at first seemed to be an exception to this rule, but was not really so. A child a few weeks old was brought to me with purulent discharge from the right eye only, said to have set in about ten days after birth. On clearing away the matter, I found the whole cornea dead, and looking like a piece of shrivelled leather. From some defect of nutrition, the part had sloughed, and the suppuration had set in afterwards, as the loosening of the dead part commenced.

The best plan of local treatment seems to consist in using, very frequently, a weak astringent lotion, so as to wash away the secretion before it has time to collect in any quantity, and thus to insure the lotion coming into direct contact with the inflamed conjunctiva. If the smooth point of a syringe be carefully placed just within the inner commissure of the lids, the wash will be propelled over the whole surface of the affected membrane.

The surgeon must strongly impress upon the nurse how much the great question of the preservation of the child's sight depends upon her regular and unremitting use of the injection. In applying it, care must be taken not to chill the child by allowing its clothes to get wetted.

But if the attack be a severe one, all local means may prove unavailing, unless the child be well nourished: the health of the mother, therefore, and her ability effectually to suckle the child, are most important points for the surgeon's consideration. For, the real danger of the disease consists, not in the profuse discharge, which so much alarms the uninformed, but in the liability of the cornea to undergo extensive *ulceration*. This morbid process it is which destroys those eyes which are said to have been lost by Purulent *Ophthalmia*. The cornea, in such cases, first becomes dull and hazy; then opaque towards the centre, with softening of its tissue; and finally, an ulcer forms, which soon perforates the whole thickness of the cornea; the iris prolapses; perhaps, if the ulcer be very large, even the lens and part of the vitreous humor escape; and the eye ultimately shrivels to a mere nodule. It depends upon the severity of the disease, but even more, I believe, upon the general vital power of the child, whether Purulent Ophthalmia prove merely a troublesome complaint, or a calamity which impairs or even wholly destroys sight. During that early period of life at which the disease shows itself,—commonly three or four days, almost always within the first week, after birth,—the interchange of material in the system is so active, and there is such a power of forming new tissues, that, if this power be only sustained by suitable treatment, it is quite astonishing to see how rapidly a large ulcer of the cornea will heal up, and with how slight an amount of opacity. When this favorable change sets in, the peripheral portion of the cornea acquires a faint pink tint, from the vessels carrying blood to repair the breach.

A child, a month old, was brought to me on the 9th of November, 1846, with Purulent Ophthalmia, which had been going on unchecked for more than three weeks. There was an ulcer in the right cornea, so large as to involve its central third, and so deep that I wondered it had not perforated the whole thickness of the part. The rest of the cornea was quite opaque, and had a slightly pinkish tinge. There was no ulcer in the left eye, but profuse purulent discharge from both. I gave a most unfavorable prognosis. On the 12th it appeared as if the ulcer had completely perforated the cornea, for there was a protrusion from its centre closely resembling a prolapsus iridis; but this was, no doubt, the posterior lamina of the cornea, thrust forward by the aqueous humor.

The ulcer healed; and, as the left eye was perfectly restored, I told the mother she must rest satisfied with such a termination of the case; for that the right eye would never be a useful one. I ordered—rather as a *placebo* than with any hope of its proving of real utility—a weak solution of sulphate of zinc to be dropped into the eye twice a day.

On July 27th, 1847, I saw the child again. It was strong and healthy, and the left eye bore no trace of diseased action. The right cornea was rather less convex than the other; the peripheral portion perfectly clear; and even at the centre, where so large and deep an ulcer had existed, there was merely a hazy opacity, through which the pupil was quite discernible.

I need hardly say that it was not the sulphate of zinc that had worked this change, but the improved vital energy of the patient; and this had, no doubt, been aided by the astringent effect of the alum injection, which I had prescribed from the first.

Weakly infants are sometimes much benefited by giving them daily a few drops of Battley's liquor cinchonæ, in a teaspoonful of milk. Blisters only exhaust and irritate such subjects; and bleeding by leeches, even to the smallest extent, may destroy the last chance of arresting the progress of a corneal ulcer.

To attempt "bringing up by hand" a feeble infant affected with such ulceration, is to doom the eye to almost certain destruction.

"SCROFULOUS OPHTHALMIA."

(*Strumous Ophthalmia; Phlyctænular Ophthalmia.*)

Perhaps there is hardly an eye disease less correctly named than the well-known irritable form commonly called "Scrofulous Ophthalmia;" for although it is very frequently met with in patients who afford decided evidence of a scrofulous constitution, it undoubtedly affects others who have never shown any such tendency. Moreover, the *cornea* is the tissue in which the disease especially manifests itself, not the *conjunctiva*, which the conventional meaning of the word "Ophthalmia" would imply to be primarily affected. I have therefore transferred the account of the affection incorrectly termed "Scrofulous Ophthalmia" to the chapter devoted to diseases of the Cornea.

CHRONIC OPHTHALMIA.

This general term is made to comprehend several affections having but little real affinity with one another. Catarrhal Ophthalmia, which has passed into a chronic form, with or without a granular condition of the eyelids; an irritable state of the tarsal margins; or a slight degree of obstruction to the passage of tears into the sac; —are all occasionally arranged under this rather vague heading.

The chronic state into which Catarrhal Ophthalmia, if not suitably treated during the acute stage, is so apt to pass, is characterized by a slight redness about the edges and corners of the lids, and a swollen condition of the caruncula and semilunar fold of the conjunctiva. When the lining membrane of the lids is examined, its vessels are found enlarged, and its surface, instead of being perfectly smooth, is slightly villous. The patient complains of the eyes watering much when exposed to a cold wind. By candlelight (and still more by lamplight or gaslight), they itch and prick, and the flame of a candle appears surrounded by a halo of prismatic colors, from the refraction caused by the thickened mucus on the surface of the cornea. The eyelashes are gummed together in the morning.

Tailors, needlewomen, clerks, and all persons occupied in working upon small objects by artificial light, especially if in ill-ventilated rooms, are frequent subjects of this form of Chronic Ophthalmia. They are often unable to take precautions for modifying the irritating effect of the light they employ: when, however, they can do so, great relief may be obtained by the use of a pale blue chimney or shade to the lamp or gas jet. Weak lotions of acetate of lead or alum, dropped into the eye night and morning, immediately followed by sluicing of the closed lids with cold water, and unguent. cetacei at bedtime, to prevent agglutination of the eyelashes, are useful in the more irritable forms of this Chronic Ophthalmia. In cases of a less active kind, unguent. hydrarg. nitratis, or unguent. zinci oxydi, diluted with fresh lard or spermaceti, may be substituted for the unguent. cetacei. These applications should not be used for too long a time, but should now and then be omitted for a week, and then resumed, if necessary. Small blisters to the temples, or tincture of iodine to the eyelids, will sometimes be found more serviceable than direct applications to the conjunctiva itself.

The surgeon must be careful to correct whatever may be faulty in the general health, and not to trust solely, or chiefly, to local means.

When watering of the eyes, on exposure to cold winds, is the symptom most complained of, the excretory lachrymal apparatus should be carefully examined. Pressure on the sac, made in a direction towards the puncta, will show whether the contents of the former consist of pure tears, or of a mucous and muco-purulent secretion. A probe of a suitable size should be very carefully passed through each punctum, as far as the inner wall of the sac, to ascertain whether the canaliculi are free from obstruction. This important examination is very frequently neglected. I shall speak of it more fully when treating of the Diseases of the Lachrymal Apparatus.

In all cases of tedious Chronic Ophthalmia, which cannot be traced either to previous Catarrhal Inflammation or to obstruction in the lachrymal passages, the surgeon should most carefully scrutinize the edges of the tarsi, and observe whether some irregularly growing eyelash may not be the cause of the irritation. A single fine hair, so delicate as to be perceptible only in a good light, and to a practised observer, is quite sufficient to cause great annoyance; and I have met with several cases where, for want of a thorough examination of this kind, patients have for months, or even years, tried in vain every form of ointment and lotion.

CHAPTER IV.

ABNORMAL STATES OF SUBCONJUNCTIVAL TISSUE.

ECCHYMOSIS.

THE bursting of a small vessel beneath the conjunctiva may take place not only in consequence of a blow, but during violent coughing, sneezing, or vomiting; or even without any assignable cause. The blood sometimes appears as a small patch on the white of the eye; in other cases it is so abundant as entirely to hide the sclerotic, and extend quite up to the edge of the cornea.

The appearance of extravasated blood is so peculiar that it can never be mistaken for the redness of inflammation produced by closely aggregated vessels.* Whether in large or small quantity, the extravasation is wholly unimportant, and will gradually disappear of itself, but it often greatly alarms the persons to whom it occurs; and they are naturally anxious to get rid, as quickly as possible, of the unsightly appearance. A poultice composed of the scraped root of the black bryony (*Tamus communis*), mixed with linseed meal or bread crumbs, applied over the closed lids, and renewed every six hours, will hasten the absorption of the blood; although not so rapidly as when the effusion has taken place beneath the skin of the eyelids themselves.

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* Dalrymple; plate vii, fig. 3. The recently effused blood is well represented, but the artist has added numerous fine vessels passing to the clot in a manner not usually seen.

One sometimes meets with cases where the surgeon, misled by some vague notion about "mercury inducing absorption," has endeavored to quicken the removal of the blood by that means. I need hardly point out the impropriety of such treatment. It is wholly useless, or, if pushed to such an extent as to depress the patient, is sure to retard considerably the disappearance of the effusion.

ŒDEMA.

This is not to be regarded as in itself a disease, but as a condition accompanying several morbid processes in the immediate neighborhood of the eyeball. Anything which, by pressing on the conjunctival veins, obstructs the return of blood from the part, may produce Œdema; and in fact *Chemosis*, in its early stage, is nothing more than this serous exudation between the conjunctiva and sclerotic. Tumors and abscesses in the orbit, thickening of periosteum about the sphenoidal fissure (through which the ophthalmic vein leaves the orbit), small abscesses in the lids, or inflammatory thickenings of their areolar tissue, may cause Œdema beneath a portion or the whole of the ocular conjunctiva.

The membrane is then raised up in the form of a watery bladder, over which a few straggling vessels ramify.* In old persons, and others of feeble circulation, Œdema sometimes advances until the loosened conjunctiva overhangs and hides the margin of the cornea.

From what I have said of the causes of this Œdema, it follows that no special treatment is to be directed towards it, but that it will subside when the pressure on the conjunctival veins is removed.

FATTY DEPOSIT BENEATH THE CONJUNCTIVA.

This is occasionally met with as a small tumor of slow growth, loosely attached to the sclerotic. A few vessels ramify over its surface, and the fat imparts a yellowish tint to the whole mass. Beneath the conjunctival covering there is a capsule of condensed areolar tissue, such as we find investing fatty tumors in other parts of the body.

I met with one of these little growths in a boy seven years of age. It resembled a French bean in size and shape, and extended along the line of junction of the lower lid with the globe, from the outer canthus to the cornea, the margin of which it had covered to the distance of nearly a line. To remove these little tumors, it is only necessary to slit up the conjunctiva and the condensed capsule investing the fat, which is then easily turned out.

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* Sichel; plate iii, fig. 5, is an admirable representation of this transparent watery appearance. Dalrymple; plate vii, fig. 4. The œdematous swelling is correctly drawn, but the general effect is that of a fatty rather than a watery prominence of the conjunctiva.

CYSTICERCUS TELÆ CELLULOSÆ.

This parasite is sometimes found in the areolar tissue between the conjunctiva and sclerotic, where it forms a rounded, watery-looking vesicle, about the size of a pea. There is some increased vascularity of the conjunctiva immediately surrounding it, and some enlarged veins are seen spreading over its surface. I have met with two cases only of this rare affection.

The first was in a young woman of eighteen, who had suffered so little inconvenience from the growth that she could not precisely say how long it had existed; and my advice was sought simply on account of the deformity. In dividing the conjunctiva, the parasite was punctured, and collapsed. The circlet of hooks surrounding the mouth was distinctly seen under the microscope.

The other case occurred in a girl aged six years. A little watery tumor rather larger than a pin's head had been noticed, it was said, eighteen months before the patient was brought to me. I found it a rounded vesicle the size of a large garden pea, midway between the inner canthus and the margin of the cornea.* It was surrounded by a good deal of conjunctival redness. The cyst was injured in removing it from the areolar tissue, or subsequently, and I could not find any hooks, so as to identify it as a *cysticercus*. Utterly unlike as *Cysticercus* and *Tænia* are, recent researches have proved them to be but two different forms of the same parasitic creature. The much greater frequency of tape-worm in Germany as compared with the British Islands, will account for the *cysticercus* being much more common in the former country than with us.

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* It presented the appearance depicted in fig. 2, pl. lxxii, of Sichel's Iconographie. In fig. 1 of the same plate a cysticercus is seen developed beneath the semilunar fold of the conjunctiva. Other figures exhibit the creature both in its natural size and magnified.

CHEMICAL INJURIES.

Heated substances, or escharotics, brought into contact with the conjunctiva, inflict injury, varying, according to the intensity of the agent, from inflammation of a transient kind to slough of the part. Where merely increased vascularity is the result, it suffices to apply water-dressing over the closed lids, and then to keep the organ at rest and defended from the light. Where melted lead or other metal has flown into the eye, the surgeon should explore the inner surface of the lids, beneath which considerable portions are sometimes found hidden.

Unslacked lime so instantaneously destroys the life of the superficial layers of the cornea, that permanent opacity is produced before the surgeon can be summoned; the cornea and conjunctiva assuming a peculiar pulpy, dead-white appearance. It has been recommended in such cases to syringe the eye with a lotion of vinegar and water, so as to decompose the lime. The lotion, however, can very rarely be applied soon enough to do more than mechanically assist in washing away extraneous matter.

Where lime or mortar has been thrown into the eye, the surgeon should always evert the lids, and remove with a scoop every particle of grit or other foreign body; but if he finds the cornea already of a pearly whiteness, he must hold out no hope of restoration of sight. When granulation is going on, he must endeavor, by using the probe, to prevent the formation of bands (*fræna*) between the opposed surfaces of the palpebral and ocular conjunctiva.

The strong mineral acids produce effects as destructive as those of lime, and the treatment of both injuries will be of the same soothing kind.

I may in this place allude to the disfigurement caused by the injudicious use of nitrate of silver. The surgeon should never allow a solution of this substance to be dropped into the eye, for the purpose of stimulating the conjunctiva or cornea, unless he has the patient under constant observation; otherwise the metal may become deposited in the substance of the conjunctiva, as an indelible brown stain. If patients are allowed to use nitrate of silver drops at their own discretion, they will sometimes continue to do so for many months, or even for a year or more. The first beginning of this stain escapes observation, on account of its always taking place at the line where the conjunctiva is reflected from the lid to the globe. It resembles a faint tint of sepia, and gradually deepens as more and more of the metal is deposited. The ocular portion of the conjunctiva is next discolored, until, if the solution be continued long enough, the whole sclerotic assumes a dirty brown hue.

In a case of this kind I first tried the effect of a solution of cyanide of potassium, applied by means of an "eye-glass," so as to insure a prolonged contact of the fluid with the conjunctiva. After several months, little benefit resulted, and I then tried, in the same manner, a solution of hyposulphite of soda. It seems reasonable to suppose that whether the brown stain were caused by the silver being deposited in a finely-divided metallic state, in the form of a chloride, or of a sulphuret, it would be dissolved by this salt; and certainly the stain was so much diminished as to lead me to expect that it would be wholly removed by a longer use of the solution.* I have since used the hyposulphite in other cases with marked benefit.

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* See Ophthalmic Hospital Reports, vol. i, p. 51.

CHAPTER V.

THE CORNEA.

ITS APPEARANCE IN HEALTH.

Duly to fulfil its important function of transmitting light, the cornea must be not only perfectly transparent, but smooth and brilliant on its surface.

When examining a patient near a window, the student will observe how clear and sharply-defined an image of the window-frame is depicted on the cornea, if it be wholly free from disease; and he will be struck by the contrast its surface presents when in a state of acute or chronic inflammation. The image is then blurred and indistinct, as if it were received on a steamy glass, and the straight lines of the wood-work look broken and wavy. It is often of great importance to mark this alteration in the epithelial surface of the cornea: as, for instance, when it accompanies those obscure changes in the deep-seated tissues of the globe collectively termed "Glaucoma;" changes so insidious in their approach, and so obscure in their earlier manifestations, that every sign becomes valuable which can aid the practitioner in forming betimes a correct opinion of their real nature.

DISEASES OF THE CORNEA.

The Cornea occasionally undergoes a very remarkable alteration, whereby its figure, which is naturally that of a portion of a sphere, becomes a cone, its transparency remaining unaltered. This rare affection is usually termed

CONICAL CORNEA.

It has also received various other names, as *Hyperkeratosis* (from a belief that there was an actual overgrowth of corneal tissue), *Staphyloma corneæ pellucidum; Keratoconus*, &c.*

Any one who has seen a well-marked case of Conical Cornea, will ever afterwards recognize the affection at the first glance. From a distance, the eye presents a peculiarly bright and sparkling appearance, as if a tear were hanging on the centre of the cornea. When viewed more closely, and in profile, the change of figure in the part is at once perceived. In all other respects the eye appears healthy, the plane of the iris being vertical, and the motions of the pupil naturally performed. The apex of the cone is almost always at the centre of the cornea, but, in certain rare instances, nearer to the margin.

Sometimes one only of the corneæ is conical; more commonly, however, both are affected, although very rarely to the same degree. When the cone is strongly developed, there is frequently a little cloudy opacity at its apex. The commencement of the deformity (which is unattended with any inflammation) usually occurs when the patient is between twenty and thirty. At first, he grows short-sighted; then, as the cone becomes fully developed, even near objects are confused and indistinct, and luminous bodies appear surrounded with a halo. The flame of a candle or lamp seems to be split into a multitude of branching rays, or, instead of one flame, several flames are seen arranged in a circle.*

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* Dalrymple; plate xxxii, fig. 1. An indifferent representation, but better than that given by Sichel.

Very few specimens of *Conical Cornea* have been examined after death; but in every instance, I believe, the central part—that is to say, the apex of the cone—has been found thinner than natural.†

It seems almost impossible to assign a constitutional cause to the deformity, so widely different in every respect are the persons liable to it. Florid, robust country people, pale, sickly artisans—those who lead an active life, and those following the most sedentary trades—may all become the subjects of this singular affection.

In proportion to the obscurity of its pathology, has been the diversity of treatment recommended for its cure. The following operative plans have been tried. Removal of the lens, by *extraction* or *solution;* displacement of the pupil towards the lateral, less prominent, part of the cornea; simple evacuation of the aqueous humor; evacuation with subsequent pressure; even cutting large slices out of the cornea. Almost every kind of stimulating, astringent, and escharotic substance has been applied either to the eye itself, or to its immediate neighborhood; but without benefit. Various plans of general treatment, more or less scientific, have been pursued, according to the supposed defects of the patient's constitution. Undoubtedly the most extraordinary was that styled the "emeto-purgative plan," which consisted in making the patient swallow a grain of tartar emetic, or a scruple of sulphate of zinc, with two, three, or even four drachms of sulphate of magnesia, *every day for the space of a year or more.* Just let the reader think over the functions of the stomach, and then say what kind of organ that must be which could with impunity undergo twelve months of such discipline as this!

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* A paper, by Mr. White Cooper, in the second volume of the London Journal of Medicine (1850), contains some figures illustrating the appearance which luminous bodies presented to a patient, the subject of Conical Cornea, who himself furnished the drawings.

† Jæger of Erlangen described the part as being extremely thin in an eye which he dissected. His account, although short, is the fullest I am acquainted with; it is contained in a German Inaugural Dissertation, published by C. Schmidt in 1830.

Several patients who had gone through an "emeto-purgative" course have come under my notice, and in no one had the slightest benefit been obtained.

When the deformity exists to only a small degree, a deeply concave glass is often of service; and when the cone has become more developed, a blackened metal plate, pierced along the middle with a transverse slit, about three quarters of an inch long, and the thirtieth of an inch wide, and fitted into a spectacle frame, affords much assistance. Thirty years ago TYRRELL, in several instances, attempted the relief of *Conical Cornea* by displacing the pupil towards the corneal margin. With his blunt hook he drew out a small portion of the iris, and excised it, leaving the cut tissue in the corneal wound. The result of these operations was unsatisfactory. Latterly, the benefit derived from the perforated plate, above described, has been taken as the basis of another form of operation. Close to the edge of the cornea a small wound is made, through which a blunt hook or a forceps is passed, and the pupillary margin of the iris, having been carefully drawn out, is then tied ("Iriodesis"). Then a similar wound is made at the opposite side of the cornea, and the iris tied as before. The result is to form the pupil into an elongated, narrow slit, extending quite across the cornea.

These delicate manipulations are much facilitated by using chloroform; and it is best to wait until the first wound is healed, and the aqueous humor retained, before doing the second operation.

In *Conical Cornea* a marked difference sometimes exists, as regards the improvement of the patient's vision, accordingly as he looks through a transverse slit or through a vertical one; and the direction in which the artificial pupil is prolonged must be determined in accordance with the peculiarity of the case in this respect.

ARCUS SENILIS.

This name is given to an opacity which, in most elderly persons, is seen close to the margin of the cornea. When fully developed, it appears as a complete circle, but it begins as a faint haziness, of a crescentic form, close to the upper or lower edge of the cornea, and, if carefully looked for, may be detected in one, or both, of these situations in many persons between thirty and forty; or even at an earlier period of life. It does not consist in an extension of the opacity of the sclerotic on to the cornea, for the extreme margin of the latter always remains more or less transparent, and appears as a narrow, darkish line between the dense white of the sclerotic and the crescentic or circular opacity I am describing. The concave edge of the opacity is gradually shaded off into the transparency of the healthy structure.

From what I have said, the reader will perceive that the term *Arcus Senilis* is by no means well chosen; for, eventually, the arc becomes a complete circle, and its formation begins at middle life, or even earlier. Indeed, I have in my case-book a note of a perfectly circular and strongly-marked deposit in both corneæ of an apparently healthy girl of eighteen.

The true nature of this change was first made known by Mr. CANTON, who discovered that it chiefly consisted in a fatty degeneration of the part. "Arcus adiposus," or "Circulus adiposus," would, therefore, be a more correct designation than that commonly employed.

INFLAMMATION OF THE CORNEA.

(*Keratitis* ;* *Corneitis*.)

Inflammation attacking the proper tissue of the Cornea, manifests itself by a general haziness of the whole structure, and a rapid prolongation of vessels into its substance. The transparency and polish which I mentioned as characterizing the healthy cornea, are lost. Its surface has the appearance of a "steamy" glass, and the image of the objects reflected upon it is indistinct. If the inflammation has existed several weeks, there is commonly some portion more opaque than the rest; this denser opacity being usually found about the centre. In severe cases, the cornea gradually acquires increased convexity, which, however, wholly or partially disappears after the inflammation has subsided. A zone of vessels in the sclerotic, immediately surrounding the cornea, is always present whenever inflammation is going on either in the cornea or iris. By remembering this fact, the student will be enabled to avoid the difficulty he would otherwise find in discriminating between corneal opacity, the result of an *extinct* inflammation, and that produced by inflammation which is *still active;* the presence of the sclerotic zone in the latter case, and its absence in the former, enabling him at once to determine the question.

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* "Keratitis" has been formed from *κέρας*, on the same principle as "Pleuritis" (a genuine Greek word, used by ancient writers) from *πλευρα*. Κέρας, horn, *κερατίτης*, horny; *κερατίτις* (*νοσος*, understood), "the disease of the horny part." Strictly, perhaps, it would mean "the horny disease." "*Corneitis*" is a bastard word, neither Greek nor Latin, but a jumble of both.

The peculiar diagnostic mark of genuine Keratitis consists in a plexus of fine vessels, arranged in a crescent, or even a semicircle, along the upper or lower edge of the cornea; sometimes in both situations; and occasionally, even, forming almost a complete circle.* These vessels, which extend into the proper substance of the cornea to the distance of half a line or a line, are so fine and so close together that they produce the effect of a smear of blood, of a dull red color, on the edge of the cornea. Close inspection, however, detects the individual vessels which constitute the plexus, and with a lens of an inch focus they may be seen forming a series of loops along the concave border of the crescent.

These plexiform patches of recent inflammation are totally unlike the vascularity resulting from chronic inflammation of the cornea, and frequently seen to follow Purulent Ophthalmia, in consequence of the mechanical irritation of granular lids. In such cases, the vascularity consists of separate venous trunks, of considerable size, which ramble all over the cornea, even as far as its centre, where they often appear as a lash of minute radicles.*

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* I can refer the reader to no good representation of this appearance. Figs. 4 and 5, plate xiv, in Dalrymple, are hard and exaggerated.

Besides the *crescentic plexus* in the substance of the cornea, and the zone of sclerotic vessels, there are always found, in cases of severe Keratitis, large and tortuous conjunctival veins running across the globe in the direction of the four recti muscles. In general, the patient suffers much from intolerance of light, and every attempt to expose the eye causes a gush of hot tears.

True Keratitis commonly occurs in children and young persons; rarely during the middle period of life. It is sometimes confined to one eye, but much more frequently involves both; and is very apt to appear in the second eye just as that which had been first attacked is getting well. In young children it may be of very short duration, and the transparency of the cornea may be recovered to a remarkable degree; but in persons above the age of puberty, and from that to twenty, it is usually very obstinate; and if the inflammation has lasted some months, and much interstitial deposit has occurred, the cornea never quite regains its transparency. There remains ever after a slight cloudiness, which is not disposed like cicatrices, in well-marked patches, with intervening clear spaces, but the whole tunic is throughout very slightly hazy.

Inconsiderable, however, as this kind of haziness may appear to the observer, it offers a very serious impediment to sight, and some experience of such cases is required to convince the surgeon that so small an amount of generally diffused opacity can have so great an influence on the patient's power of distinct vision.

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* Dalrymple; plate xv, fig. 1.

Treatment.—I am aware that the treatment of Acute Inflammation of the Cornea, recommended by those whose opinions are entitled to the utmost attention, from their large experience and high scientific attainments, comprises active depletion, in the form of general and local bleeding, and the administration of mercury so as to affect the mouth. Nevertheless, I must express my decided conviction that both bleeding and "mercurialization" are most injurious. I speak, be it observed, of that form of inflammation which is characterized by a general haziness of the cornea, the peculiar *crescentic plexus* of vessels at its margin, tenderness of the globe, intolerance of light and lachrymation, and which occurs, for the most part, in young persons of a manifestly delicate and irritable frame; or in those who, with an outward appearance of what may almost be termed *vigor*, are really over-excitable, and as readily depressed by local disease as the habitually pale and exsanguine. Such patients are always injured by mercury, but under the steady use of tonics, especially iron, with or without quinine, the inflammatory symptoms subside, the vessels which had begun to shoot into the cornea dwindle and disappear, the haziness is lessened, the irritability of the eye subsides, and the organ is gradually restored to usefulness. Counter-irritation, by means of repeated small blisters to the temples, or behind the ears, is an important aid to the tonic treatment. Of all mischievous applications to an inflamed cornea, that of nitrate of silver is the most injurious. It does unmixed harm; and yet it is largely employed, in deference to some traditional routine, based probably upon the benefit which follows its use in cases of conjunctival inflammation.

SO-CALLED "SCROFULOUS OPHTHALMIA."

When treating of diseases of the conjunctiva (chap. iii), I said that the affection commonly termed "Scrofulous Ophthalmia" was incorrectly so called, that it was essentially a corneal disease, and I therefore postponed its consideration, until I should come to treat of inflammation of the cornea.

The form of Keratitis I would now describe is chiefly met with in patients above two years of age and below puberty. The most prominent symptom is extreme intolerance of light (*Photophobia*), and the lids are often so forcibly closed by involuntary spasm, that it requires all the surgeon's tact to obtain a thorough view of the cornea, which sometimes can be effected only by the aid of the spring speculum. The intolerance of light is often much increased by the too common but most injudicious practice of keeping the patients in dark rooms. After many hours of darkness, the sudden admission of light is of course extremely painful.

Frequently the evidences of local inflammation in the eyeball are trifling, as compared with the distress evinced by the patient. We find on the cornea a small cloudy speck, an ulcer, or a slightly elevated whitish point, like a minute pustule; or there may be several such morbid appearances. But whatever form the inflammatory deposit or the ulcer may assume, we invariably trace a reddish streak, formed by a lash of fine vessels, extending to the speck from the edge of the cornea.

Should the cornea be more deeply affected, it becomes hazy throughout, and traversed by vessels in various directions; or softening, and deposit of pus, may occur within its substance.

The sclerotic exhibits more or less of the pink zone, in proportion as the corneal inflammation is more or less considerable. The conjunctival injection is chiefly seen in the enlargement of the veins running in the course of the recti muscles.

The secretion of tears is very abundant, and they gush out every time the lids are drawn asunder. Violent sneezing often attends the admission of light to the eyes, especially in those truly scrofulous patients whose nasal membranes are in a constant state of unhealthy irritability, with over-secretion of mucus. Swelling of the lips and alæ nasi, fissures about the nostrils and behind the ears, various forms of impetigo and eczema, and enlargement of the cervical glands, are all accompaniments of inflammation of the cornea in scrofulous subjects.

There is no disease of the eye so tedious, so liable to relapses, and in all respects so trying to the surgeon's patience, as that now under consideration; and in a work like the present I can but briefly indicate the chief heads of treatment.

Constant attention to the state of the bowels is necessary, and an occasional purge of calomel and rhubarb is most useful; or, in a very young child, minute doses of calomel followed by a little manna; but anything like a "mercurial course," as it is termed, I hold to be most mischievous, and likely in every way to aggravate the complaint. To allay irritability—to strengthen the digestive power—and to improve the quality of the blood—should be the object of our general treatment. Locally, we should abstain from over-stimulating and *teasing* the eyes, and employ such applications only as are grateful and soothing. Counter-irritation, short of weakening the patient, affords the greatest relief. Abstraction of blood I cannot conceive admissible in any case. As for the barbarous proceeding termed "scarification of the conjunctiva," it is so nearly obsolete that one may hope to see it, ere long, discarded from ophthalmic practice.

As internal remedies, I would place in the very first rank iron and bark. The iron I usually give in the form of tinct. ferri sesquichloridi, or as the syrup. ferri iodidi; the bark as liquor cinchonæ.

In very weakly children, cod-liver oil may supersede both these medicines. Where there is restlessness at night, and extreme intolerance of light during the day, patients are often much benefited by a few drops of tinctura hyoscyami, or a few grains of the extract, at night, or even night and morning.

I have said we should avoid irritating the eyes with too stimulating applications, especially with the abominable nitrate of silver drops; and indeed I believe that, during the irritable stage, occasional fomenting with warm water, and at night applying a little unguent. cetacei, or sweet oil, to the eyelashes, comprise nearly all that is prudent to be done. Afterwards a lotion of acetate of lead (two grains to the ounce of distilled water), or a weak solution of alum, may be employed twice or thrice a day. Lead lotions, however, must never be employed so long as there is any unhealed ulceration on the cornea; otherwise some of the white precipitate may be deposited on the abraded surface, and give rise to indelible opacities.

Counter-irritation, by means of blisters, is, of all local means, the most common in so-called "Scrofulous Ophthalmia;" and certainly they often, in a most marked degree, relieve the intolerance of light. I prefer them about the size of a shilling, and usually direct them to be removed from the temples at the end of four or five hours, whereby the skin is less deeply inflamed, and the blistering can be repeated at shorter intervals.

Tincture of iodine, if painted on the skin of the lids very carefully, so that none of the liquid runs into the eyes, is sometimes even more efficacious than blisters in subduing the intolerance of light. In most cases it may be repeated twice a week.

But all remedial measures will be in vain unless proper care is paid to the child's diet and mode of life. Plenty of plain, nourishing food should be given; but there should be no over-feeding. Some of the most troublesome cases I have ever seen have been those where a young child, of three or four years, has been *stuffed* with meat twice a day, with beer at dinner, and even a little wine besides; while at the same time, the bowels were constantly worried with some mercurial preparation, and a solution of nitrate of silver was dropped, night and morning, upon the irritable eyeball.

Confinement to dark, close rooms is of all things the most prejudicial. A large shade should be worn in the house, and a gauze veil may be added or substituted, when the child is taken out of doors, which should be done when the weather is dry and fine.

SYPHILITIC KERATITIS.

To the careful observations of Mr. HUTCHINSON we owe the true knowledge of this remarkable form of corneal inflammation. I do not mean that he discovered a disease which had never been seen before; on the contrary, it was in patients who would have been selected as affording typical specimens of "Strumous Ophthalmia," that he first pointed out the morbid appearances as being due, not to Scrofula, but to Inherited Syphilis. He named the disease "Chronic Interstitial Keratitis;" but I think we may now fairly discard this longer term, and briefly designate it as *Syphilitic Keratitis.* There being no special form of Keratitis connected with *acquired* Syphilis, the term I have placed at the head of this section will be always understood to imply an inflammation due to *inherited* disease.

The subjects of this form of Keratitis are children and young persons from five to eighteen years of age. The disease begins at the centre of one cornea, in the form of a diffused haziness, like that of ground glass. Very soon whitish dots appear in the midst of the haze; not on the surface, but in the very substance of the cornea. The dots generally run together, and thus increase the amount of central opacity. At first there is but little attendant vascularity of the sclerotic or conjunctiva, but as the central opacity becomes more marked, these tissues become reddened, and a fine plexus of vessels spreads on to the cornea itself, and gradually pervades the opaque portion, affecting the upper and central part of the cornea in preference to the lower half. Throughout the whole course of the disease there is no tendency to ulceration.

Usually within about two months—or it may be much earlier—the other cornea begins to be affected, the disease commencing, as in the eye first attacked, by a central haziness.

The vascularity of the cornea, when the disease is at its height, is wholly unlike that which attends granular lids, and other chronic forms of Keratitis. In the latter the vessels are large and superficial, whereas, in the disease now under consideration, they penetrate the cornea so deeply, and are so fine and so closely set together, that the effect produced is that of a tissue infiltrated with blood.

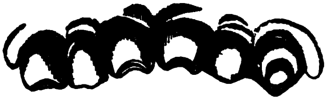
So far from the "Chronic Interstitial Keratitis" being a scrofulous affection, in the ordinary sense of the term, Mr. Hutchinson has observed the subjects of it to be but rarely affected with enlargement of the cervical glands; while in thirty-one out of the sixty-four cases he has recorded, he obtained a clear history of the occurrence of syphilitic symptoms during infancy, such as "rash," sore mouth, ulcers about the anus, prolonged "snuffles," &c.

Most frequently it is an eldest child that comes under observation; and females appear to be more liable to the affection than males.

"In almost all cases, the subjects of this Keratitis," says Mr. Hutchinson, "present a very peculiar physiognomy, of which the most striking signs are, a coarse flabby skin, pits and scars on the face and forehead, cicatrices of old fissures at the angles of the mouth, a sunken bridge to the nose, and a set of permanent teeth peculiar for their smallness, bad color, and vertically-notched edges." He adds,—"As diagnostic of hereditary syphilis, various peculiarities are often presented by the other teeth, especially the canines, but the upper central incisors are the *test-teeth.* When first cut, these teeth are usually short, and the cutting edge is narrow from side to side, and very thin. After a while a crescentic portion from their edges breaks away, leaving a broad, shallow, vertical notch, which is permanent for some years, but between twenty and thirty usually becomes obliterated by the premature wearing-down of the tooth."

When Mr. Hutchinson first published his observations, he had not met with a single example of well-characterized "Interstitial Keratitis" in which the teeth were of normal size and shape; but longer experience has brought under his notice several exceptional cases, in which all the appearances of Syphilitic Keratitis were present in association with well-formed teeth. I met with one very remarkable case of this kind in a young lady, who presented the most severe Keratitis I ever saw, who had the well-marked physiognomy, and whose history quite confirmed the suspicion of inherited syphilis, and yet whose teeth were quite remarkable for soundness and symmetry. We also exceptionally meet with cases of unmistakable Syphilitic Keratitis in patients whose complexion is clear and ruddy, and the features well formed; but to find a well-marked case of the disease in a patient with healthy general aspect, and with healthy teeth also is, I think, next to impossible.

I often find that surgeons, who have not read Mr. Hutchinson's descriptions, but have merely heard of the diagnostic "notched teeth," confound *serrated* edges, such as one sees in newly-cut healthy incisors, with *notched* edges. "Serrated" implies a series of notches; the *single* notch to which Mr. Hutchinson first drew attention will be at once understood from the annexed sketch, copied from one of Mr. Hutchinson's illustrations.



Even in grown-up patients, whose incisors have been so much worn that the notch has become obliterated, the tooth retains a form which is still diagnostic. I compare it to that of a *screw-driver*, being wide at the base, where it joins the gums, and narrow at its cutting edge; its lateral edges are also bluntly rounded off. The lower incisors, too, retain to the last a form approaching the cylindrical, the lateral edges being rounded off as in the upper teeth just described.

It must always be borne in mind that the teeth of the first dentition in syphilitic children, although commonly dwarfed, and prone to premature decay, do not exhibit the notches. They are only seen in the permanent set.

Treatment.—Good diet, pure air, and all things calculated to improve the condition of the blood and tissues, are of primary importance in treating the cachectic subjects of Syphilitic Keratitis. I believe iron, in some shape or other, to be the one drug needful. It should be given in small doses, because the cure is necessarily very slow, and the medicine must therefore be continued for many months. An occasional small dose of calomel—a grain or so once a fortnight—is requisite to prevent the iron deranging the functions of the liver; but I do not think that what is called "a mercurial course" is either necessary or beneficial. The forms of iron I prefer are the tinctura ferri sesquichloridi, and syrupus ferri iodidi. For a young child, six or seven years old, eight or ten drops of the tincture given once a day directly after food will be a full dose, and each fortnight it may be left off for a day or two, and a grain of calomel given. Even for patients of sixteen or eighteen, the dose of the tincture need never exceed fifteen or twenty minims.

The more aggravated forms of Syphilitic Keratitis require, as I have said, a long time for their cure; and the surgeon must ever bear this in mind, and not be discouraged at the tedious progress towards recovery. If only the vascularity of the cornea disappears, and from month to month the part becomes less opaque, the case may eventually terminate most satisfactorily, even if it requires steady perseverance for a year. In very severe cases it is unreasonable to expect that absolute transparency of the cornea will be restored.

A slight amount of Iritis not uncommonly attends the severer forms of Syphilitic Keratitis; and when the pupil has become visible, a small adhesion may here and there be seen between the capsule of the lens and the iris.*

"EXANTHEMATOUS OPHTHALMIA."

Under this head, authors have arranged several forms of inflammation,—*Ophthalmia morbillosa*, *O. scarlatinosa*, *O. erysipelatosa*, *O. variolosa*, &c. But in fact these cannot be considered as special, or separate diseases; nor can they, for the most part, be termed *Ophthalmiæ* at all, according to the strict meaning of the word. They may be reduced under one general head of *Ulceration of the cornea from impaired nutrition.*

Injection of the conjunctiva, and an abundant flow of tears, are, indeed, among the best known marks of an attack of measles; but this sort of Ophthalmia commonly requires no special treatment. It is after the eruption has passed off, and the patient is left weak and exhausted, that ulcers of the cornea are apt to appear, accompanied sometimes with the intolerance of light and other symptoms, commonly described as characterizing "Scrofulous Ophthalmia." Hence it is that these ulcers are such a common sequel of measles among the poor, with whom the eruptive attack is rarely followed up by a course of tonic treatment.

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* Mr. Hutchinson's earlier observations appeared in the Ophthalmic Hospital Reports for 1858, vol. i, and the Transactions of the Pathological Society. vol. ix, p. 449. He has since published a complete treatise on the subject as A Clinical Memoir on certain Diseases of the Eye and Ear. 1863. Still more recently he has contributed New Facts and Opinions as to Inherited Syphilis, &c., to the second volume of Clinical Lectures and Reports by the Medical and Surgical Staff of the London Hospital. 1865.

In like manner scarlatina is sometimes succeeded by corneal ulceration, although, from the extreme depression so frequently caused by this terrible disease, its consequences are even more severe than those which succeed to measles; and even slough of the whole cornea occasionally happens in children who have had scarlatina in its most exhausting form.

Every one is familiar with cases in which sight has been lost in consequence of small-pox. They are characterized by large and dense opacities of the cornea, often converting the whole extent of that tissue into a chalk-white cicatrix, over which arborescent veins are sometimes seen to ramify. The globes are frequently much shrunken, and have a constant rolling motion.

Formerly these opacities were attributed to the formation of small-pox pustules on the cornea; but Mr. Marson, resident surgeon at the Small-pox Hospital, in an interesting paper which he communicated to the London Medical Gazette,* announced, as a well-ascertained fact, that *pustules never form on the cornea*, even in the most severe attacks of variola; but that rapid ulceration, which sets in during the period of extreme prostration succeeding the eruptive stage, is uniformly the cause of the opacities just mentioned as so common a cause of blindness.

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* Vol. xxvi, p. 204. 1839.

INFLAMMATION OF CORNEA, WITH SUPPURATION.

In simple Keratitis, the opacity is due to inflammatory deposits in the tissue of the cornea; and after the inflammation has subsided, these deposits may become absorbed, and a cornea which had been so hazy that the position of the pupil could not be discerned, may regain very nearly its healthy transparency. Such excellent recovery, however, seldom happens, except in children, in whom a rapid and active interchange of material exists throughout the various tissues of the body.

A very different result follows that form of Keratitis which is attended with the formation of *pus* among the fibres of the cornea, or with loss of its substance by *ulceration.* In both these cases, permanent opacity—a cicatrix, in fact, more or less dense—invariably remains. It is, therefore, of importance that the surgeon should use his utmost endeavors to limit, as much as possible, the spread both of suppuration and ulcers in the substance of the cornea.

Soon after the onset of an acute Keratitis, while the cornea is hazy, the intolerance considerable, lachrymation profuse, and the sclerotic much injected, one part of the cornea (commonly the centre, or a spot a little below that point) may become whitish, and densely opaque; then yellowish, indicating the formation of pus. Although this is commonly spoken of as "*Abscess* of the Cornea," it must be remembered that the pus is not contained in a distinct, circumscribed cavity, as commonly happens when suppuration occurs in other tissues of the body. It is infiltrated among the fibres of the true cornea, which become softened and broken down; so that if a puncture be made (as has frequently been recommended), the matter does not escape. We know that the true fibrous cornea is bounded before and behind by a firm layer of almost cartilaginous density—the anterior and posterior elastic laminæ; these for a considerable time resist the softening process, and the pus continues to be infiltrated more and more among the fibres of the true cornea.* Commonly the posterior lamina is the first to give way, and the pus slowly oozes into the anterior chamber, and sinks to the bottom of that cavity, where it assumes the appearance of a crescent, and is termed "Hypopyon."† The disease may stop here; the pus in the anterior chamber being absorbed, and the site of its deposit in the true cornea becoming permanently opaque.

It more frequently happens, however, that within a very short time of the posterior lamina giving way, the anterior one yields to the same process of softening. In that case the aqueous humor slowly drains away, the iris falls against the cornea, and the anterior chamber is obliterated. The site of the suppuration is now marked by a grayish white patch, the surface of which is flocculent with little shreds of the softened corneal tissue. These gradually fall off, and then a perforating ulcer of the cornea is established, through which the iris may protrude, appearing as a small brownish nodule in the centre of a whitish or yellowish depression.

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* Sichel; pl. ix, figs. 5 and 6. Hypopyon is shown in two stages of Keratitis, with perforating ulcer of the cornea.

† A good deal of confusion exists as to the names given to this deposit of pus in the anterior chamber; one set of writers terming it Onyx, another Hypopyon. The former word, again, is by some employed to denote a patch of suppuration within the substance of the cornea—an abscess. The best way to rid ourselves of the difficulty is, I think, to discard altogether the unnecessary word Onyx from our vocabulary.

Severe *Neuralgia* often attends the formation of pus within the substance of the cornea; and those who have not been in the habit of seeing such cases would hardly believe that a little yellow patch, not bigger than a section of a hempseed, could be the cause of sleepless nights, and days of acute suffering, requiring the administration of full doses of hyoscyamus or morphia. As soon as the whole thickness of the cornea has given way, in the manner I have described, the aqueous humor escapes, and the pain ceases.

The manner in which these cases of suppuration of the cornea terminate, depends very much upon their treatment. If, at the time when the corneal tissue (either its anterior or posterior layer) is giving way, and allowing the slow exit of the pus, the patient be depleted and kept on low diet, a large perforation of the cornea, and a proportionate protrusion of the iris, are almost sure to take place; but if the patient's powers be properly supported by good nourishment and stimulants, and by tonics—as bark and ammonia, or quinine—not only will the ulceration stop short of forming a large breach in the cornea and giving rise to *Prolapsus Iridis*, but frequently only one surface of the cornea, the posterior or the anterior, will give way, the other retaining its vitality; and even if complete perforation should have taken place, the process of reparation will go on so rapidly that the aqueous humor will be retained, and the iris, which may have fallen against the cornea, will even recover its natural position, the site of the suppuration being occupied by a firm cicatrix. In such cases, although a central opacity of the cornea must ever afterwards remain, and of course prove a great hindrance to vision, very useful sight will be enjoyed through the lateral, healthy portions of the tissue; and such an eye (in the event of the other being lost) may be restored to almost its original perfection by judicious displacement of the pupil, by operation.*

Our *local treatment*, in these cases of suppuration in the cornea, should be of the simplest kind. Fomentations of warm water, or of poppy decoction, may sometimes afford relief while the suppuration is going on; but as soon as the cornea has given way, perfect rest of the part is to be enjoined. The eye must be kept constantly closed, and not be examined, even by the surgeon, except from time to time to ascertain the progress of the case. A small quantity of cotton-wool, arranged around the edge of the orbit, and kept in place by means of a light bandage, forms perhaps the best dressing for insuring gentle closure of the lids.

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* See the chapter on Artificial Pupil.

ULCERATION AND OPACITIES OF THE CORNEA.

Some of the more formidable kinds of corneal ulceration have been already described in the chapters on Purulent Ophthalmia, and Exanthematous Ophthalmia, while a more chronic form has been mentioned as characterizing the so-called Scrofulous Ophthalmia. There are, however, other forms of ulceration which cannot be brought under any of these heads, but must be separately considered. A few remarks may be suitably made, at the same time, on the appearances presented by corneal ulcers in general, and by the various opacities which result from their cicatrization, or from inflammatory and earthy deposit.

Thoroughly to examine a corneal ulcer, the light from the window must be made to fall directly upon it; the excavation which it forms is thus appreciated, and the observer can at a glance distinguish between a true ulcer and a mere hazy spot, appearances which in a dull light may easily be mistaken for each other; for where the ulcerative process is still actively going on, there is commonly very little opaque halo around the edge of the excavation; sometimes, indeed, there is none at all, the ulcer resembling a little hollow made in a piece of clear glass by chipping out a fragment from its substance.

The edge of an ulcer in which the destructive process has ceased, and reparation begun, is always more or less hazy, and at the same time there will be found some vascularity of the sclerotic immediately adjoining that part of the cornea where the ulcer is situated; and occasionally a fine vessel, or a delicate plexus of vessels, may be traced from the vascular portion of the sclerotic to the border of the ulcer itself.

These vessels are too often regarded as evidences of an unhealthy action in the part, whereas they are nothing more than the channels through which reparative material, necessary to the filling up of the ulcer, is conveyed to it. A small breach of surface in the cornea can be repaired without any noticeable development of new vessels; but if the breach be extensive (as, for instance, when a considerable portion of the fibrous tissue has been broken down by suppuration), a vascular plexus forms the necessary apparatus for organizing new material; and as soon as the work of repair has been accomplished, the vessels dwindle, and gradually disappear.

When the general vigor of the patient has been well maintained by suitable treatment, an ulcer in healing usually fills up to the level of the healthy cornea; but in feeble subjects, or where the ulcer has been very large and deep, the cicatrix remains permanently depressed. An inexperienced observer may readily mistake such a cicatrix for an unhealed ulcer; but if the part be examined with the light falling full upon it, the margin of a depressed cicatrix will be found to be smoothly rounded off, whereas a true ulcer always presents an edge more or less sharp and abrupt. In most cases, also, the absence of vessels in the cornea and the adjacent sclerotic, distinguish the perfected cicatrix from the ulcer which is still in progress.

When an ulcer has completely perforated the cornea, the aqueous humor of course escapes, the iris falls forward, and a portion of it protrudes through the aperture, forming what is termed *Prolapsus Iridis.* The protruded portion appears as a brownish nodule, surrounded by the grayish or yellowish margin of the ulcer. In some books on ophthalmic surgery, the reader is directed carefully to push back again with a probe such protruded portions of iris; but he is not told how they are to be *kept* back. It must be self-evident that they will slip out again the moment the probe is removed; and therefore, instead of wasting time in such fruitless efforts, the surgeon must endeavor to produce speedy adhesion between the protruded iris and the edge of the corneal ulcer with which it lies in contact. This adhesion will be hastened by suitable tonic and stimulant treatment; and very often further protrusion is checked, and the healing up of the ulcer quickened, by very carefully and lightly touching the parts with a finely-pointed stick of nitrate of silver.

I may notice in this place a form of ulceration (fortunately very rare, and of which I can at present recollect only two or three cases) in which a crescent-shaped ulcer, beginning at the edge of the cornea, slowly but steadily extends until it has formed a completely circular groove, isolating the central portion of the cornea, which, by that time, has become opaque. The ulceration goes on until it has gradually destroyed this isolated portion, and indeed the whole of the cornea except the posterior lamina, which perhaps gives way only at one or two points. In the cases I allude to, the patients were between forty and fifty years of age; not suffering from any marked impairment of health: indeed, one of them was a stout, hearty-looking man from the country. Although the appearance of the ulceration itself was in these patients so like that ulceration which accompanies Gonorrhœal Ophthalmia, I satisfied myself that they had no urethral discharge. There was a total absence of all acute inflammatory symptoms in the conjunctiva and sclerotic, but of course both structures presented some increased vascularity. There was but little intolerance of light, and not much pain. No treatment was of any avail, and each patient wholly lost the sight of one eye, the other cornea remaining unaffected.

Ulceration of the Cornea is one of the results of disease of the fifth nerve, but when arising from that cause does not present any peculiarity requiring special notice in this place.

Opacities of the Cornea have received different names, according to their density. Those having a whitish, cloudy appearance are called *nebulæ*, while the perfectly opaque white patches are distinguished by the terms *Albugo* and *Leucoma*. A forced distinction has sometimes been drawn between the two latter terms, but their etymology shows them to be perfectly synonymous (λευκος= albus).

Cloudy opacities, diffused throughout the greater part of the cornea, result from long-continued inflammation of its tissue (*Keratitis*): those which are confined to certain portions of the cornea, the rest remaining clear, are the effect of superficial ulcers. The perfectly opaque, chalky-white patches overspreading a large part, perhaps nearly the whole, of the cornea, are the cicatrices succeeding to extensive suppuration, and breaking down of its fibres. Penetrating ulcers produce cicatrices almost as white and opaque as those following suppuration; but the former are of smaller size, and they have almost always a portion of the iris adherent to their posterior surface. Caustic lime, when it does not produce actual slough of the whole cornea, and subsequent *Staphyloma*, renders the part opaque; but the opacity has not that chalky appearance which follows the loss of corneal substance, and the formation of a cicatrix: it rather resembles what one sees in the dead subject when decomposition is just commencing.

From the frequency of corneal opacities, and the deformity they occasion, the surgeon's aid is continually being sought to remove them, and it would be an endless task to enumerate the various substances which have been, and still are, recommended as specifics. Stimulating drops, ointments, and powders, have each their advocates; and no doubt corneal opacities disappear, or diminish, under the use of many of these applications; but so they do when no application whatever has been employed. I have already alluded to the manner in which the diffused opacity of Keratitis clears off as the inflammation ceases. Every ulcer at the time of its healing is surrounded by a halo, which, when cicatrization is completed, slowly disappears. In infancy, when the interchange of material in tissues is so active, this disappearance of the haze surrounding an ulcer is more rapid, and even transparent corneal substance is, perhaps, to a certain extent reproduced, which is never the case in the adult. If, therefore, after all inflammatory, or reparative, action in the cornea has ceased, drops or lotions be continued for a certain time, the clearing, which is really due to the ordinary process of nature, will be attributed to the medicated application. *Time*, I believe, is the great clearer of corneal opacities; and the surgeon who is consulted respecting those which follow recent ulcers in children, may comfort the friends with the assurance that as the children grow up, the specks—they can never wholly disappear—will become smaller, and less noticeable, provided no fresh inflammation should set in. If, however, the speck is of old date, and its margin abruptly defined, it is useless to attempt its removal.

The student and young practitioner are so apt to be led away by great names, that I would put them on their guard against the specifics which some of the older medical writers extol so highly, as capable of removing corneal opacities.*

To pare them away seems at first sight a much more feasible proceeding than to wear them off by friction, and the former plan is still revived from time to time, with various modifications as to the extent and manner of the operation. But when we remember the fact that (in the adult at least) transparent fibres are not reproduced in the cornea, it will be evident that each successive loss of its substance can only give rise to a fresh opacity.

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* It is not likely, indeed, at the present day, that any one would try the plan sanctioned by the classic name of Mead; who, in his Chapter "Of the Albugo," recommends us to use equal parts of powdered glass and sugar-candy, levigated to an impalpable powder: a little put into the eye *every day*, he says, "gradually absterges and wears off the spot, by its inciding quality." The other method is "to order a dexterous surgeon to pare it cautiously *every day* with a knife." He adds, with amusing candor, "the paring of the cornea has not succeeded with me above once or twice." (The Medical Works of Richard Mead, M.D., 8vo. Edinb. 1775, p. 410.) Still droller was the suggestion of Darwin: "Could not a piece of the cornea," he asks, "be cut out by a kind of *trephine* about the size of a thick bristle or a small crowquill, and would it not heal with a transparent scar?" "An experiment," he adds, "I wish strongly to recommend to some ingenious surgeon or oculist." (Zoonomia: third edition, 1801, vol. iii, p. 71.) Even in our own day it has been proposed to remedy the blindness occasioned by total opacity of the cornea by cutting a hole through it and inserting therein a small piece of glass, shaped like a shirt-stud. This, Dr. Nussbaum hopes, will not only be permanently worn there by the patient, without inconvenience, but will act as a substitute for the transparent cornea. (Zeitschrift für wissenschaftliche Zoologie; vol. v, p. 179, 1853.)

Deposits, in the form of permanent white patches on the cornea, are described by some writers as frequently resulting from the application of acetate of lead in solution to the surface of ulcers; while TYRRELL and others allude to such occurrences as being very rare. They certainly do sometimes happen. I saw an instance in an old lady, who, while tending her flowers, was struck on the cornea by a pointed leaf, which caused a slight abrasion of epithelium. She had among her stores a bottle of lotion, which she appears to have regarded with great veneration, as a sovereign remedy for all sorts of eye diseases, having kept it by her for about two years. During that time the acetate had become decomposed, and the old lady, thinking that all the good stuff was at the bottom of the bottle, took care to shake up the white deposit, and drop some of it into the eye. At the end of a few days she came to me, and I found a chalky-white patch occupying the centre of the cornea, and hiding the pupil. I carefully scraped off the newly-formed epithelium, and with it the deposit of carbonate of lead, and found the cornea beneath perfectly clear. As soon as the epithelium was re-formed, all opacity was gone, and the vision quite restored.

Calcareous Deposit.—This is a curious form of opacity, depending upon spontaneous deposit of earthy salts between the epithelium and the anterior surface of the cornea. It was first observed by myself; at least, I am not aware of its having been met with earlier than the following date.*

October 16th, 1848. John Trevelyan, aged fifty-eight, a cabinet-maker, applied at the hospital, complaining of dimness of sight, which within the previous six months had been gradually getting worse, until it had entirely prevented him from following his trade. His eyes, when cursorily viewed by a person directly in front of him, seemed to have no pupillary apertures; but, on closer inspection, it was found that this appearance was the effect of a transverse opaque band, passing along the equator of each cornea, so as entirely to hide the middle third of the iris. These bands were of a brownish tint, closely resembling that of the irides, and about a line and a half in breadth at the middle of the cornea, but tapering off towards its inner and outer margins. The opacity seemed superficial, as if just beneath the epithelium; and, when minutely inspected, it was seen to be traversed by a few delicate dark lines—fine cracks, apparently in the deposit. Through the upper and lower, quite transparent portions of the corneæ, an oblique view of the pupils could be obtained. These were rather small, but perfectly healthy in appearance, and the patient could distinctly see objects placed above or below the level of the eye.

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* By a strange coincidence, it happened that while this patient was in attendance at the hospital, a second instance of the same affection came under the notice of Mr. Bowman, who at that time took part with me in seeing out-patients. I furnished him with a report of my case, and he published it, together with his own, in the Appendix to his Lectures on the Anatomy of the Eye.

Except the opacities of the cornea, no morbid condition could be detected in either eye; and the patient stated that there had been no inflammatory symptoms during the time the dimness had been coming on.

Thinking it possible that the deposit might nevertheless be of inflammatory origin, I tried the effect of counter-irritation by means of issues in the temples; but, no benefit having resulted, I attempted to remove the opacities by operation, and having very carefully scraped off the epithelium from the centre of the right cornea, found a layer of hard matter beneath it. This was closely united to the proper substance of the cornea, and could be raised from it only in small flakes, and with much difficulty. Wherever a fragment of the deposit was chipped off, the cornea beneath was found perfectly transparent. I cleared a space equal to the area of the dilated pupil, and applied to the denuded surface a drop of castor oil, to soothe the extreme pain which the patient complained of. The irritability of the eye had quite subsided in the course of about ten days, and the spot where the deposit had been removed was covered with new, and perfectly transparent, epithelium.

I then performed the operation on the left eye, with an equal satisfactory result. I saw the patient afterwards, and his sight was excellent, enabling him to work at his trade as well as ever. The deposit which I left undisturbed near the inner and outer margins of the cornea presented the same aspect as it did when I first saw the case; and the edge of the opacity surrounding the clear space appeared as abruptly broken as at the time of the operation.

My friend, Mr. Thomas Taylor, the well-known chemical lecturer, kindly examined the flakes I removed, and found them to consist of phosphate and carbonate of lime. In the case seen by Mr. Bowman the deposit was without any brown tinge, but had the whitish appearance of ordinary corneal *nebula*.

INJURIES OF THE CORNEA.

Abrasion of Epithelium.—A light scratch on the surface of the cornea will sometimes scrape off a portion of its epithelial covering; and it would be impossible for any one who had not actually witnessed the effects of this seemingly trifling injury to believe it could give rise to such acute suffering as it sometimes produces, especially in persons of an irritable nervous system. I have seen men almost fainting in consequence of the pain resulting from the edge of a sheet of paper, the cuff of a coat, or an infant's finger nail, coming in contact with the cornea, even although the
on of epithelium was so minute that it re-
the most careful examination to detect it.
brasion is usually best seen if the surgeon
e patient opposite a window, and stands

behind him, raising the upper lid, and fixing it against the edge of the orbit, while the patient moves the eye in different directions, so as to allow the light to fall on each portion of the corneal surface. Sometimes a minute flap of the membrane will be found doubled down; at other times, the surface of the cornea, at one small spot, appears roughened to a hardly appreciable extent. The admission of light—or rather the motion of the lids in the attempt to open the eye—causes a sudden dart of pain; and there is sometimes a considerable amount of zonular redness in the sclerotic. The most soothing application, and one which causes instantaneous relief, is a drop of perfectly fresh oil upon the surface of the cornea. Castor oil is the best, but olive oil may be used as a substitute. The eye should then be closed with a suitable bandage, which should only be removed, after a lapse of several hours, for a re-application of the oil. In cases of extreme irritability, it is well to bandage both eyes for twenty-four hours, to insure perfect repose of the injured one. As soon as a fresh layer of epithelium has been formed, all pain ceases, and the sclerotic redness soon subsides.

To those who have not witnessed the effect of this accident, it will seem almost ridiculous in me to have said so much about its treatment; but in fact a large clean wound of the cornea—such, for instance, as that made for the extraction of a Cataract—seldom gives rise to as much real suffering as the little abrasions I have been describing.

PENETRATING WOUNDS OF THE CORNEA.

These differ widely in their importance (as is the case in wounds of other parts of the body), accordingly as they are *punctures*, clean *incisions* with sharp instruments, or the result of *contusions*.

As regards the appearances they present, all are easily recognized if seen immediately after their infliction; but when the parts have become obscured by the effusion of fibrine, blood or pus, it is sometimes extremely difficult, or quite impossible, to form a correct estimate of the injury. Within a few hours the edges of a clean cut of the cornea become hazy, and the wound is at once traceable as a whitish line; but if the patient be seen directly after the receipt of the wound, while its edges are still transparent, it may require the closest scrutiny to detect it; for sometimes the edges lie in such nice apposition, that the greater part of the aqueous humor is retained, and no deformity of the pupil exists. If, however, as more commonly happens, the aqueous humor has drained away, the obliteration of the anterior chamber, caused by the falling forward of the iris against the cornea, will aid the detection of the wound. Where a portion of the iris has been forced into it, the case of course speaks for itself.

Just as we often meet with scalp-wounds, which have been inflicted with blunt bodies,

then absolute rest, and a due performance of the nutritive functions, are the main requisites. It is quite astonishing to see some surgeons, who, in the case of an incised wound of the arm or leg, or a compound fracture, would never think of doing more than I have just mentioned, resorting, as soon as an incised wound of the cornea comes under their notice, to bleeding, purging, low diet, and the administration of mercury; while they perhaps overlook the one thing needful,—absolute rest of the wounded part.

It is sometimes very difficult, or even impossible, to remove the foreign body which has caused a corneal wound, as it may have penetrated the iris, or gone through the pupil into the depths of the eye; but whenever it can be seen, an attempt should be made to extract it, by enlarging the wound, if necessary, and employing such instruments as the surgeon's good sense and ingenuity may suggest as applicable to the particular case. The elasticity of the corneal fibres is such that they will allow a foreign body, if projected with great rapidity and force, to traverse them, and will then instantly close up again; so that, but for the positive evidence of the body, in the anterior chamber, iris, or pupil, one could not believe it had passed through at all.

If the iris protrude between the lips of the wound, an attempt should be made to replace it with the small spatula. My remarks as to the inutility of attempting this reduction in cases of perforating ulcer of the cornea, do not apply to incised wounds. In the former there is actual loss of substance, and the breach can be filled up only by a slow process of repair; in the latter this is not the case, and it may be possible to place the lips of the wound in such close apposition that further escape of the iris, or even of the aqueous humor, may be prevented, and rapid union may ensue.

The Treatment of Incised Wounds of the Cornea, attended with partial dislocation of the lens, will be noticed in a future chapter.

When a fragment of stone or metal strikes the cornea, and bruises without rupturing it, very serious consequences often ensue, especially in old or enfeebled persons. In hospital practice, such accidents are met with in their severest form among old men employed in stone-breaking. Suppuration within the substance of the cornea quickly sets in; and the eye at first presents an appearance very similar to that described as characterizing inflammation of the cornea. The softening and breaking down of the fibrous tissue rapidly extend, until the whole is reduced, except perhaps the extreme margin, to a grayish or buff-colored mass. As soon as the aqueous humor escapes, the pain, which had previously been severe, subsides, and the case terminates in *Staphyloma.* By supporting the patient's feeble powers with ammonia and bark, good diet, and suitable stimulants, and, if necessary, soothing pain by the use of narcotics, some check may occasionally be put to the destructive process;

but in feeble subjects there is seldom any chance of saving vision.

Much of what I have said with regard to the appearances presented by *incised wounds* of the cornea, will apply to *punctures*. Of course these appearances differ according to the time which has elapsed before the patient is seen by the surgeon, and the nature of the penetrating body. Whenever the cornea has been perforated, there is a likelihood of the lens having been injured, and the pupil should therefore be carefully explored. Sometimes the lens does not show any opacity until several hours after it has been wounded. When the puncture has been made with a thorn or a splinter of wood, a portion of the foreign body is often left sticking in the wound, and it should be carefully looked for and extracted. A striking instance of the different results of punctured wounds of the cornea was afforded by two patients who came under my care about the same time. One, a boy, aged eleven, received a wound of the cornea and lens from the point of a rusty steel pen. Suppuration within the anterior chamber rapidly took place, extending behind the iris; pus pointed in the sclerotic just above the upper margin of the cornea, and was evacuated. Finally the cornea became opaque, and the whole eye disorganized.

The other patient, a child three years old, ran a clean, sharp sewing-needle through the middle of the cornea, and punctured the lens. Within a few days the slight irritation caused by the in-

spicuously on the cornea. Pointed chips of metal, projected with violence, are commonly driven firmly into the tissue; but the small scales and flakes of metal, fragments of coke, &c. (which are the bodies most commonly met with), extend no deeper than the epithelium, and sometimes even lie flat on its surface. To *dig* out such little bodies with a pointed cataract-needle or a lancet, as many surgical works advise, is not only unnecessary, but injurious, as causing needless injury to the cornea, every puncture of which is followed by more or less of permanent opacity.

If the surgeon has thoroughly commanded the movements of the patient's eye, by placing the point of one finger on the sclerotic, just above the cornea, and the other against the inner side of the globe, he has only to tilt out the foreign body by inserting beneath it the thin rounded extremity of a little spatula-shaped instrument, which is known at our hospital as a *spud.*

If the foreign body be a scale of iron, which has remained some days on the surface of the eye, the metal, having become oxidized, will crumble under the instrument, so that it must be removed piecemeal. Should any considerable surface of epithelium have been disturbed in the operation, a drop of oil will prove a soothing application. Bathing with warm water, and resting the eye for a day or so, are usually all that is required by way of after-treatment.

If a sharp little fragment of metal be driven straight into the cornea, so that one end projects above the surface, it may be seized with a well-[illegible] [illegible]-shutting forceps, and drawn out.

[illegible] more management is necessary if the fragment [illegible] [illegible] in a slanting direction, and [illegible] [illegible] completely among the fibres of the cornea. [illegible] [illegible] to pick out such a fragment [illegible] [illegible] drive it still deeper, or even [illegible] [illegible] through the posterior lamina of the [illegible] [illegible] anterior chamber. A little cut [illegible] [illegible] made, with a cataract-[illegible] through the superficial fibres of the cornea [illegible] the whole length of the fragment, [illegible] [illegible] with the spud.

[illegible] knowledge to have trans-[illegible] tends back-[illegible]

[illegible] ished [illegible] is at [illegible] may use both his hands at once, provided the lids be kept asunder with the spring speculum.

The operation above described is one which I would not advise a beginner to undertake; for he would be very likely to wound the lens with the broad needle, and thus produce Cataract. This risk may be guarded against by making the incision at the outer margin of the cornea, with a cataract-knife, and just large enough to introduce the small spatula, the edges of which, being blunt and rounded off, can neither wound the lens nor the hinder surface of the cornea. Special care should be taken not to rotate the blade in making the wound for its introduction, for fear of evacuating the aqueous humor.

FOREIGN BODIES IN THE AQUEOUS CHAMBERS.

Bodies which are lying loose in these cavities may sometimes be got rid of by simply making an incision through the cornea sufficiently large to allow of their escaping with the aqueous humor. Others may require, in addition, the aid of some kind of forceps—the *canula-forceps*, or ASSALINI's—to draw them out. In no case must the practitioner delude himself into a belief that chips of copper (fragments of percussion-caps, for instance), however minute, will in time become *absorbed.* They may even become encysted in the iris, and remain quiet for years, and then, from some cause or other, set up inflammation which may destroy the eye. In the Dublin Journal of

Medical Science, for August, 1848 (p. 210), is the case of a patient of mine, in whom a tiny scale of copper cap remained fixed in the iris for eight years, during which time it gave rise to repeated attacks of Iritis. At last it made its way through the cornea by ulceration. I am not aware of any instance in which a foreign body has remained so long in this situation and been ultimately expelled.

CHAPTER VI.

THE SCLEROTIC.

APPEARANCE IN HEALTH.

THE term "white of the eye," popularly applied to this part, cannot be said accurately to describe its appearance at any period of life. In infancy it has a bluish or leaden cast; its thinness allowing the dark color of the choroid to show through it. During adult life it becomes thoroughly opaque, and the bluish cast disappears. In elderly persons it acquires a yellowish tint, with patches here and there of a dull drab color.

In some eyes, at a distance of a line from the margin of the cornea, little brownish blotches are to be seen, from each of which a small vessel emerges to pass backwards along the sclerotic. If these blotches be examined after death, they are found to consist of round foramina in the sclerotic, with thin bevelled margins. They have been regarded as evidences of a congested state of the choroid;* but this cannot be their true signification, for I have repeatedly met with them in persons whose sight was perfect.

Whenever the sclerotic is inflamed, the conjunctiva is more or less involved; the carmine, or slightly violet tint of the former, being overspread with the more vermilion network of the latter, membrane. I have described these appearances in Chapter III.

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* Dalrymple has figured them as such on his twenty-first plate, fig. 1.

Sclerotic Inflammation, although so commonly associated with inflammation of other parts, as the iris and cornea, may exist without any disease in those tissues. It assumes two very distinct forms,—Acute and Chronic.

In the former, the redness is equally diffused over the surface of the eyeball; there is sometimes such extreme intolerance of light, that it requires much tact and patience in the surgeon to make his examination; each admission of light causing fresh pain and a gush of hot tears. Intense neuralgia throughout the ophthalmic division of the fifth nerve, occasionally extending to the other divisions, sometimes attends an acute attack of Sclerotic Inflammation, and deprives the patient of sleep, unless full doses of morphia be given. Attacks of this kind are much modified by rheu-

Chronic Inflammation rarely involves the whole surface of the sclerotic. The upper, lower, inner, or outer half, may be deeply injected, while the rest of the globe exhibits only a slight increase of vascularity. The intolerance of light is but trifling, and patients can, to a certain, extent follow their ordinary occupations; the cornea, iris, and other important tissues, remaining quite free from disease. In this chronic affection, quinine is very useful; and blisters, applied to the temple or behind the ear, act most beneficially.

Exposure to cold and damp winds must be carefully guarded against, as it will often bring back an inflammation which had become almost extinct.

MACKENZIE describes both the *acute* and the *chronic* inflammation of the sclerotic under the name "Rheumatic Ophthalmia," but he does not "believe this Ophthalmia to be an inflammation differing *in kind* from common inflammation, in consequence of the existence of what has been called the rheumatic habit or diathesis." "Were I asked," he says, "'What is meant by *Rheumatic* Ophthalmia?' I should answer—'By Rheumatic Ophthalmia, I mean simply inflammation of the fibrous membrane of the eye (the sclerotica), and of the surrounding parts of similar structure, excited by exposure to cold.'" And he adds—"I have adopted the term *Rheumatic Ophthalmia*, but perhaps *Sclerotitis idiopathica* would be a truer appellation."

In the severer forms of the acute disease, however, there is sometimes decided evidence of rheumatic complication; the urine being highly acid, and depositing in abundance the characteristic red sediment. These are precisely the cases in which colchicum is often found so beneficial.

STAPHYLOMA SCLEROTICÆ.

This name is given to a bulging of the sclerotic, with thinning and partial separation of its fibres, the result of fluid pressure, acting, from within the cavity of the globe, upon tissues which have undergone a slow degeneration.

When, in consequence of Iritis, combined with disease of the choroid, the pupillary margin has become united to the capsule of the lens, and the communication between the anterior and posterior aqueous chambers is cut off, the fluid secreted in the posterior cavity, continuing to accumulate, thrusts the iris forwards, thinning it and distending it into irregular pouches, which almost or quite touch the hinder surface of the cornea. At the same time, the fluid exerts pressure on the anterior portion of the sclerotic, and stretches its fibres, so that they yield, and form a *Staphyloma* —a tense, bluish-black prominence, streaked with whitish lines (the separated fibres of the sclerotic), passing in an antero-posterior direction. A single prominence of this kind may exist, in which case it is usually found at the upper part of the globe; or the whole of the sclerotic between the line of insertion of the recti muscles and the margin of the cornea may be more or less prominent and lead-colored.*

When *Staphyloma Scleroticæ* forms farther back than the line I have mentioned, it is usually produced by effusion of fluid (*subsclerotic dropsy*) between the sclerotic and choroid, as a result of inflammation.

As affording proof of morbid changes in structures more important than the sclerotic itself, *Staphyloma Scleroticæ* is a very serious affection. It is incurable by medical means: if any attempt be made to remove it by an operation, this would be undertaken solely for the purpose of remedying a deformity; such an excrescence being never met with save in a thoroughly damaged organ.

WOUNDS OF THE SCLEROTIC.

These are usually so self-evident, that I need say little about the mode of detecting them. When the sclerotic alone is injured, the gaping of the wound exposes the black surface of the choroid. If the latter also be divided, the retina bulges into the aperture, as a bladder-like membrane; while rupture of the retina itself is attended with protrusion, and, most commonly, escape of the vitreous body.

Clean cuts, and punctures inflicted with sharp instruments—as in the various operations of extracting portions of opaque capsule, or in the older modes of using the needle to a Cataract—readily heal up without giving rise to inflammation. Accidental cuts, besides being often of much greater extent than those made in surgical operations, are always the result of violent blows, which at the same time impart a shock to the whole eye.

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* Dalrymple; pl. xx, fig. 6; pl. xxiv, figs. 2, 5, and 6, show extreme cases of Staphyloma Scleroticæ.

What has been said respecting the treatment of corneal wounds, applies equally to those of the sclerotic. Absolute rest of the eye is the most essential point; all disturbance of it, by unnecessary inspection, or by too frequent fomentation, should therefore be avoided.

It has been asserted that " wounds of the sclerotic do not unite;" but I am at a loss to conceive how such a statement could have originated. If the term "union" be arbitrarily restricted to mean, " repair of a wounded part by newly-formed substance, absolutely similar in structure to the original tissue," there is, perhaps, no such process as *union* to be met with in the human body; for the composition of every cicatrix differs from that of the once-severed parts which it brings again into apposition. But if the word be taken in its ordinary acceptation, then, most assuredly, wounds of the sclerotic *do* unite, and very closely, too.

RUPTURE OF THE SCLEROTIC, WITH SUBCONJUNCTIVAL DISPLACEMENT OF THE LENS.

That the sclerotic and choroid should be extensively ruptured, the conjunctiva remaining uninjured, and that the lens, slipping out through the rent, should become lodged beneath the unbroken conjunctiva, would *à priori* appear a most improbable occurrence. Such an accident, however, sometimes comes under the notice of ophthalmic surgeons.

From the recorded cases, it would appear that the point where the sclerotic usually gives way, is either *above* the cornea, or to its *inner* side. Among upwards of thirty published cases, I do not find one in which the sclerotic has been burst below the cornea, or to its outer side; nor have I myself ever observed such to be the case when rupture of the sclerotic, without displacement of the lens, has occurred. Now, as the sclerotic is equally thick and strong at all points of any circle drawn concentrically to the circumference of the cornea, the rupture, if it were produced by direct violence, would as often occur at one side of the eyeball as another. But it seems that the sclerotic bursts under the extreme bending of its fibres, which takes place at the point nearly *opposite* to that which receives the blow; and this is commonly inflicted on the outer or the lower side of the globe, where it is most assailable; the inner and upper sides being protected by the prominence of the nose and supraciliary ridge.*

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* Shortly after the first edition of this volume was published, I saw a most curious case illustrative of the statement in the text. A man in fighting received on the *right* eye a blow, which ruptured its coats to the inner side of the cornea, and drove out the lens, either beneath the conjunctiva, or quite through a rent in the latter membrane. The pupil afterwards remained misshapen and drawn inwards, and a bluish line marked the spot where the rupture had taken place.

Two years later the man fought another battle, and was struck on

I may take this opportunity of saying a few words as to what happens when, from an accident or otherwise, matter forms within the globe. The thinnest part of the sclerotic is that immediately behind the insertions of the recti. The tendons of these muscles enter wholly into the substance of the sclerotic, without uniting to form any such superficial expansion as is mentioned in the older anatomical works under the title of "tunica albuginea." A circle described on the sclerotic concentrically to the circumference of the cornea, and distant from it about a quarter of an inch, will, roughly speaking, correspond to the lines of insertion of the tendons; and the upper part of the space included between this circle and the margin of the cornea is the spot where pus almost invariably points, when it is making its way outwards from the interior of the globe. Here, too, the dark-colored protrusions termed "Staphylomata Scleroticæ" form by the thinning of this coat from undue secretion of fluid in the posterior aqueous chamber. For although, as I have said, the sclerotic is in itself weakest just behind the insertion of the recti, this weakness is compensated by the action of the muscles; and it is the thicker portion of the coat in front that yields, either to the pressure of fluid from within, or violence from without.

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the *left* eye. The sclerotic was ruptured at its inner side, and the lens displaced beneath the unbroken conjunctiva. I was present when the lens was removed by one of my colleagues, under whose care the patient had been admitted to the hospital.

The appearances presented in a case of ruptured sclerotic, with or without displacement of the lens, will vary a good deal, according to the amount of hemorrhage. Sometimes the anterior chamber will be found full of blood, and when that is the case any injury which the iris may have sustained will pass unrecognized until the blood has been absorbed. Such an injury, however, may be expected; for, in a large proportion of recorded instances, the shock appears to have extensively separated the iris from its ciliary attachment.

In a recent case, where much hemorrhage has taken place, the conjunctiva covering the seat of rupture will be found raised up by the effused blood, which will also envelop and hide the lens, should dislocation of that body have occurred. But should the accident come under the surgeon's notice after the subconjunctival effusion of blood has become absorbed, he will at once recognize the displaced lens by its peculiar form, as traced beneath the unbroken conjunctiva.*

The prognosis of ruptured globe, with displacement of the lens, and partial or total separation of the iris from its attachments—even if unattended with laceration of the retina, or large extravasation of blood—must, of course, be very unfavorable: and yet the history of recorded cases of this accident shows it to be by no means of so invariably destructive a kind as to deter the surgeon from all hope of doing good. But he must not trust too much to "energetic treatment;" for those cases seem to have done best eventually where there was the least amount of interference with the reparative efforts of Nature, but where the one essential—perfect repose of the injured organ—was secured.

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* The eye would then more or less closely resemble fig. 4 in Sichel's nineteenth plate.

The striking benefit attending the use of mercury in some idiopathic inflammations of the eye, has led many persons to believe that it must be as effectual in combating inflammation resulting from violence. But those who, in the latter case, employ bleeding and mercurializing, seem to overlook the fact, that when the coats of an eyeball have been divided, Nature's first attempt towards repairing the mischief consists in *increasing, not lessening*, the flow of blood to the part. The breach can only be filled up by the organization of material deposited there by the blood: to bring the patient under the influence of mercury, diminishes the tendency of such material to become organized, and thus counteracts the very efforts Nature is making to repair the breach. As to "moderating the determination of blood to the part," inasmuch as we have no means of precisely knowing how much blood is necessary to furnish an adequate quantity of reparative material, we may, by bleeding, be depriving Nature of her very material for cure. The blood of one patient is rich in reparative matter, the blood of another is poor. What means have we of appreciating the exact quantity of this matter, which, in any given patient, is being carried to the wounded eye?

All that the surgeon can do, when called into cases of ruptured globe, is to inform himself, as well as he is able, of the habit of the patient, and endeavor to keep his powers as near the standard of everyday health as possible. The local treatment consists in maintaining the wounded part *in perfect repose*, both in respect of motion and light. For this purpose it is not sufficient to bandage only the eye which has been wounded. Both eyes must be kept covered, or the movements of the sound one will of course be accompanied by corresponding movements of the other. A week or ten days is not too long a time for keeping the lids *uninterruptedly* closed, without examining the injured part. Premature motion, and exposure to light, are almost sure to be followed by irritation and pain.

I need hardly add, that in cases of subconjunctival displacement of the lens, that body is to to be removed by carefully dividing the conjunctiva covering it. Should the iris have been detached from its connections, and hang out of the wound, it must be snipped off close to the surface of the globe. These, and all other manipulations which may be found necessary, should, of course, be performed as much as possible without pressure on the eyeball; and this evil may be best avoided by holding the lids asunder with a speculum. By some surgeons it has been recommended to delay the removal of the displaced lens, for a few days, to allow time for the breach in the sclerotic to close. This delay would manifestly be improper if the lens were found to be the cause of pain. In that case it must be removed at once.

That the state of the patient's bowels should be attended to; that, if restless, he should be soothed with such narcotics as experience may have proved suitable to him, or as the surgeon's judgment may suggest; that the amount of food should be regulated by the vigor of the patient's circulation; and stimulants either given or withheld on the same grounds: all these are points which must be left to the good sense of the surgeon, since no fixed rules can be laid down as applicable to the treatment of all cases.

CHAPTER VII.

THE IRIS.

CONGENITAL DEFECTS.

The irides are sometimes wholly absent, a condition which has been termed *Irideremia;* but in most of the cases which are so denominated, there really exists a slight rudiment of the iris, which, on close observation, may be traced as a very narrow, colored ring—or more commonly as a crescent—skirting some portion of the margin of the cornea.

Children affected with *Irideremia* appear to be confused and dazzled by ordinary daylight, and unable to fix the eyes on any definite object, rolling them about uneasily in various directions. The fundus of the globe, when a favorable view of it can be obtained, has a red tint, and the edge of the lens is seen as a ring of golden light.

Coloboma is the name given to a congenital malformation of the iris, whereby the border of the pupil is left incomplete at one part, the aperture therefore assuming a pyriform figure, lengthened out to the margin of the cornea. In the embryo the iris and choroid are formed out of the same vascular membrane, which becomes curved upon itself, and united into one substance along the median plane of the eyeball. An arrest of development, therefore, will at the same time give rise to a median deficiency both of the iris and choroid. I have never seen a coloboma except along this line, or a little to the side of it; but figures exist of colobomata directed upwards and sideways.* I fancy these have really been pupils displaced towards the margin of the cornea by old wounds.

Coloboma Iridis usually coexists in both eyes, though not always to an equal extent. The absence of corneal cicatrix will serve at once to distinguish the affection from elongation and displacement of the pupil, resulting from old *Prolapsus Iridis.*

If the margin of a *Coloboma* be carefully examined, it will usually be found that the actual opening which transmits light is not quite so large as a superficial observer might at first have fancied it to be; for as the deficiency of the uveal layer of the iris is less extensive than that of the anterior fibrous layer, the aperture in the latter appears fringed with a margin of black or blackish brown tissue. The appearance of the Coloboma of the choroid, as seen with the ophthalmoscope, is very remarkable.

Displaced pupil.—Sometimes the pupil, retaining its rounded form, is placed close to the margin, instead of opposite to the centre of the cornea. The absence of cicatrix in the latter structure would in this instance, as in a case of Coloboma, enable the surgeon to recognize the deformity as congenital.*

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* Dalrymple; pl. xxxii, fig. 4, shows Coloboma in a downward, and pl. xxxii, fig. 5, in a lateral direction.

It is said that in rare instances the "pupillary membrane" which exists in the fœtus, is not absorbed; and its persistence at birth may give rise to a belief that the infant is the subject of congenital Cataract. I have never met with a case in which the whole of this membrane was persistent after birth, but I have occasionally seen in adults what appeared to be slight vestiges of it, in the form of little tags or spurs of the fibrous tissue of the iris, projecting from that part to which the pupillary membrane had been attached. This membrane, it must be recollected, is not united with the iris, at the extreme edge of the pupil, but at some little distance external to it, and could therefore be mistaken for a cataract only by one whose notion of a cataract was of the vaguest kind.

I need not allude at any length to the peculiar aspect which the iris presents in those persons termed *Albinoes*, as their general appearance is so remarkable as immediately to arrest the attention of the most superficial observer. The deficiency of black pigment in the choroid and uvea of the

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* Several figures of Coloboma and misplaced pupil will be found in Von Ammon's Atlas; others in Sir William Wilde's Essay on Malformations and Congenital Diseases of the Organs of Sight. 1862. The largest colobomata I ever saw were in a patient of my own. They are represented in the first volume of the Ophthalmic Hospital Reports; pl. i, fig. 2.

Albino, imparts a pink color to the pupil and iris; the surface of the latter being also marked by a variety of wavy, whitish lines and loops, intermixed with others of a faint lilac color.

Intolerance of light is the most marked inconvenience which their defect of pigment entails on these persons.

APPEARANCE OF THE IRIS IN HEALTH.

The most striking phenomenon of the healthy iris is its motory power, whereby the pupil is alternately enlarged and diminished, so as to regulate the amount of light admitted to the retina.

It is important to bear in mind that the motions of the iris are usually less brisk in old subjects than in young ones; and in elderly persons we frequently find a small pupil, which hardly undergoes any perceptible change under varying degrees of light, without any disease existing in the iris itself, or in the retina. This partial immobility of the iris is also occasionally noticed in persons of middle life.

A very contracted and immovable state of the pupil is described by some writers under the name of *Myosis;* but I cannot say I have met with it as a simple and independent affection. Some persons who have naturally very small pupillary apertures enjoy such excellent sight, that we are not warranted in calling such a state of the pupils—morbid.

Dilatation and immobility of the pupil constitute a well-known symptom—by no means, however, an invariable one—of impaired function of the retina; but they may also exist quite apart from any such retinal defect. *Mydriasis* is the term applied to this fixed dilatation of the pupil, originating in a loss of motory power in the iris; such a condition as may be artificially induced by belladonna, or naturally follows total paralysis of the third cerebral nerve.

Cases of simple Mydriasis, being attended with indistinctness of sight, are often designated by the formidable term " Amaurosis." A simple experiment suffices to determine the real nature of the case. Let the patient supply the want of a contracted iris by looking through a small aperture, such as a pin-hole in a card held close to the eye. If the case be one of *Mydriasis*—dilated pupil, with a sound retina—he will see perfectly; but if the retina be affected, the aperture will either be quite useless, or at the utmost, afford very little assistance.

The *treatment* of Mydriasis is not easily reduced to precise rules, as the affection may originate in various ways. Exhaustion of nervous energy, dyspepsia, intestinal irritation from worms, &c., rheumatism—all seem in turn to be the exciting cause. Tonics, alone or in combination with purgatives, colchicum, strychnine, as an internal medicine, or applied "endermically," powdered ergot of rye, snuffed up the nostril of the affected side, —all these and other means have been employed with but little success. The discovery of the remarkable property of the Calabar bean has at once placed at our command a substance which induces contraction of the pupil as completely as Atropine dilates it; but I have not met with a case of true Mydriasis in which the Calabar bean, however efficacious at the time, has effected a permanent cure. It is best applied by means of little disks of gelatine, as invented by Mr. Streatfeild.

Tremulousness of the Iris is met with in very various degrees. Sometimes the vibrations of the part are so slight as to be hardly noticeable, except on the closest inspection; in other cases the whole iris flaps loosely to and fro with every movement of the globe. This flaccidity seems to depend on various causes, but to be almost always connected with some loss of the natural consistence of the vitreous body. After the operation of extraction of Cataract, the site of the removed lens becomes occupied with aqueous humor; and this alteration in the support afforded to the iris by the surrounding media, and the stretching to which the pupil is subjected by the passage of the lens through it, are probably the combined causes of the tremulousness and want of contractile power in the iris, which so frequently follow the operation.

To observe those very slight vibrations of the iris which are met with in some eyes apparently free from serious disease, the patient should be so placed that the light falls on the iris sideways; its vibration will then be found to accompany each action of winking.

Variety of color is so remarkable a characteristic of the *Iris*, as to have caused that name to be given to the structure. It may assume every shade, from the palest blue-gray to dark or blackish brown, as in the negro; and it is important to remember that some healthy irides are particolored. An iris may be half gray and half hazel, or there may be a patch of one or the other color, without any disease having existed in the part. Sometimes brown or blackish pigment is seen on the anterior face, assuming the form of little tufts, slightly elevated from the surface.

A third characteristic of a healthy iris is its peculiar fibrous aspect. This is difficult to describe in words, but must be familiar to all, and its loss is one of the most striking symptoms of inflammation. The round shape of the pupil is equally familiar. This aperture is not placed exactly at the centre of the iris, but a little nearer to the median plane of the body. In some persons, the narrowness of that portion of the iris internal to the pupil, as compared with that external to it, is very marked. The edge of the pupil is sometimes a little thickened, and of a different tint from the rest.

Such, then, being the appearance of the Iris in health, we may consider its changes in inflammation, as respects its *mobility*—its *color*—its *texture*.

INFLAMMATION OF THE IRIS (*Iritis*).

We first meet with the word "Iritis" in a treatise by SCHMIDT, of Vienna, published in 1801, where that form of the disease is described which so commonly followed the operation for Cataract, as performed in his day.

But if the older surgeons failed to detect this most important disease, the moderns have surely gone too far towards the opposite extreme; and, while making minute subdivisions which are of no practical utility, have overlooked the fact that, in what is called *Iritis*, other textures of the eye besides the iris are often the seat of active inflammation. This has been well alluded to by JACOB, where he says of Iritis, that "the use of the term has the effect of directing the practitioner's attention to the iris, which bears a great deal of inflammation, without destruction to the organ, and withdrawing it from the retina, which bears very little without permanent injury to the vision;" and he adds, "I would therefore (with the greatest respect for the opinions of the eminent men who have written on the subject) suggest that the term should be abandoned, as mischievous, and calculated to lead inexperienced persons astray, by fastening their attention on the iris, where the retina should be the prominent object." Now it would be too great an innovation, I think, to discard a word so universally employed, unless we could substitute one altogether unobjectionable; and it will be sufficient, if the student bear in mind that the anatomical connections of the iris with other parts of the eye are so intimate that inflammation in the iris always more or less involves the deeper textures of the eyeball. The passages I have just quoted were published by Dr. Jacob many years before the invention of the ophthalmoscope, but the revelations of that instrument fully confirm the truth of his remarks. For instances of syphilitic affections of the retina, the reader is referred to the section on Syphilitic Iritis.

The best proof of the inutility of minute subdivisions of eye diseases is, that those who have had the largest field of practice, and have devoted most time to its cultivation, have made the fewest divisions and used the simplest nomenclature. Lawrence, in his Treatise on Diseases of the Eye, divides Iritis into *acute* and *chronic*, and admits, as modifications of the disease, the *syphilitic*, the *gouty* and *rheumatic*, and the *scrofulous*.

None but those who have read the works of German surgeons can be aware of the absurdly minute and unpractical subdivisions of Iritis that have been described and uncouthly named in treatises published thirty or forty years ago. But the discovery of the ophthalmoscope has thrown open such a new world of investigation, that the over-cultivated domain of the iris has been of late comparatively abandoned.

Whatever may be the degree of inflammation of the iris, or however the disease may be modified by peculiar conditions of the system, there is one unfailing sign which demands the surgeon's attention—I mean the *vascular zone in the sclerotic.*

It is at the junction of the cornea and sclerotic that the communication between the deep and the superficial vessels of the eye takes place; and hence we may judge pretty accurately of the amount of internal congestion of the organ by the intensity of this zonular redness. Some large vessels which pass along the globe seem to terminate abruptly in the vascular zone; but these are veins, which do not dip in, but emerge, at this point, and convey blood away from the deeper textures of the eye. In old cases of Glaucoma, these communicating trunks attain a large size, and assume a dark purple tint.

An inflamed iris loses its contractile power. At a later period, when the inflammation is subdued and the part has regained its healthy aspect, it may still remain immovable from a different cause, namely, on account of fibrinous adhesions having formed between it and the capsule of the lens. A thickening of the pupillary margin is another early symptom of Iritis, and whether mere distension of the vessels or a deposit of fibrine be the cause of this thickening, it is quite natural it should take place at the edge of the pupil, where the arteries and veins form their most free anastomosis. We have seldom the opportunity of seeing an iris in its first stage of inflammation, as it is not until vision has become impaired, either by deposit of fibrine in the pupil, or by extension of the disease to the deeper textures of the eye, that a patient applies for medical advice.

A very remarkable symptom in inflammation of the iris is its *change of color*. If the part be naturally of a bluish tint, it becomes greenish;

in hazel or brown irides, the change is less observable. The cause of this change is commonly said to be the deposit of lymph in the substance of the iris; but it chiefly depends upon yellowness of the aqueous humor.

If in an eye which has suffered from old Iritis, producing permanent greenness of the iris, a puncture be made through the cornea with a broad needle, the fluid of the aqueous chambers, as it flows out, will be seen to have a golden yellow color; and if the iris be originally bluish, that tint will be perfectly restored as soon as the last drop of fluid has drained away. If the fluid be caught in a spoon, the presence of albumen may be demonstrated by the application of heat.

Appearances common to all cases of Iritis are —a red zone in the sclerotic, close to its junction with the cornea; more or less deformity of the pupil, and loss of its normal mobility; a change of color in the iris; loss of its peculiar fibrous appearance.

Symptoms which depend upon the specific character of the inflammation—upon its degree of intensity and duration—upon the susceptibility of the patient, or the extension of inflammation to other tissues of the eye, are—deposit of lymph* on the surface of the iris and in the anterior chamber; the appearance of vessels in the iris; closure of the pupil, or adhesion of its margin to the capsule of the lens; pain, and impairment of vision; opacity of the cornea; and permanent opacity of the lens or its capsule.

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* I use the word "lymph," as being familiar, to designate that which exudes from the vessels, without entering into the question whether it becomes itself converted into fibrous tissue, or whether it only influences the cells of the tissue among which it is effused, and so causes new cells to be developed from those already existing.

The first form of Iritis which I shall speak of is the *Traumatic;* I shall next consider that arising *without external injury*, as modified by different morbid conditions of the system—Rheumatism, Syphilis, and Scrofula.

Very little inflammation follows a simple incised wound of the iris. This fact is illustrated by various surgical operations, wherein the part is cut either by accident or design. If, in the operation for extracting a Cataract, the aqueous humor escapes too soon, the margin of the pupil, or even a larger piece of the iris, folds over the edge of the knife. If the knife cannot be liberated, it is thrust on, and a piece of the iris shaved off. Blood flows from the wound into the anterior chamber, and hides the lens from view; but if the capsule be sufficiently lacerated, the lens commonly escapes with great facility through the artificially enlarged pupil, and little further hemorrhage takes place. When the eye is examined on the fourth or fifth day after the operation, the blood has commonly disappeared, and the iris exhibits a healthy aspect.

Again: in making an Artificial Pupil, where the iris is intentionally divided, either by cutting or tearing, we seldom find inflammation of any consequence come on, unless the operation be roughly performed, or the iris have previously suffered from disease.

But a very different result attends those wounds of the iris which are accompanied with displacement of the lens; and the symptoms are still more serious if the wound extends to the cornea, so as to cause the escape of the aqueous humor. In such cases the iris becomes squeezed between the cornea in front, and the dislocated lens behind. Vessels are seen traversing the iris, and lymph is poured out on its surface and on the capsule of the lens. If the cornea has been wounded, it participates in the inflammation, becoming at first hazy and afterwards highly vascular. A deep-red zone surrounds its circumference, and the redness extends throughout the whole of the sclerotic, and no doubt, in many cases, to the deeper textures of the choroid and retina. The patient suffers constant pain in the eye, especially at night; exposure to light increases the pain, and is followed by gushes of scalding tears. When the inflammation at length subsides, the pupil is found to be closed with lymph, and all useful vision extinct.

This form of Iritis is so uncontrollable, on account of the constant irritation kept up by the displaced lens, that it has been proposed, in such cases, to anticipate inflammation by enlarging the corneal wound, and extracting the lens, as soon after the accident as possible. Mr. Barton, of Manchester, was, I believe, the first to suggest this operation; and in the Medical Gazette for the year 1830, he related several cases in which he tried it with good results. In the present day the use of the scoop would obviate much of the danger which at the time Mr. Barton wrote attended the removal of a broken up and displaced lens.

Of course, it is not to be supposed that whenever the cornea and lens are wounded, extraction of the latter is to be attempted. Such accidents occur every day, and, *provided the lens be not displaced*, they usually terminate well. A greater or less protrusion of the iris may take place through the wound in the cornea, which gradually heals up. In the meantime, the lens, which had become opaque, is absorbed (except in very old persons, where its structure is too dense and firm), and if the opaque capsule prove an impediment to sight, it may afterwards be carefully lacerated with a needle, and useful vision restored.

What has been said respecting the treatment of Iritis, caused by the pressure of a displaced lens, will apply in some measure, to that which follows the entrance of *foreign bodies* into the anterior chamber. If the patient is seen shortly after the accident, before effusion of lymph has taken place, and while the foreign body is still free and unattached, an incision through the cornea, proportioned to the size of the body, may give exit to it. But if inflammation of the iris has already set in, and the foreign body be enveloped and hidden in lymph or pus, it is probable that any attempt to extract it will be fruitless, and only give rise to increased irritation.

Mercury, which is such an invaluable remedy in other inflammations of the iris, has little effect, comparatively, in that which results from injury. The surgeon must wait, and be on the watch to take advantage of the first opportunity, which the partial disappearance of the exudation may offer, to seize and extract the foreign body.

We come now to consider those inflammatory affections of the iris which arise *independently of injury.* They present themselves under two principal forms: the one is characterized by a rapid appearance of red vessels in the iris itself, and extension of inflammation to the sclerotic, and posterior surface of the cornea, attended with that intolerance of light which always accompanies inflammation of these fibrous tissues. Effusion of lymph takes place slowly and to small extent, chiefly showing itself in bands passing from the edge of the pupil to the capsule of the lens, and on the surface of the latter mixed with patches of pigment. This form is described under the name of *Rheumatic Iritis*, and an attack of it may usually be traced to some of those causes which, under certain conditions of the fluids of the body, give rise to rheumatism in other organs—as sudden exposure to damp, and to cold currents of air, especially when the body has been previously overheated.

This inflammation is especially characterized by a tendency to involve the sclerotic and cornea, producing a mottled opacity of the latter, which remains after the more violent inflammatory symptoms have subsided; and it is distinguished from that of purely syphilitic origin by being less prone to the excessive effusion of lymph on the surface of the iris and into the anterior chamber, which occurs in the latter disease.

Partly from actual vascular distension, and partly from being viewed through a hazy medium, the iris, in Rheumatic Inflammation, has a dull and cloudy aspect; the pupil is contracted, more or less misshapen, and its margin thickened and reddened with distended bloodvessels.

The converging red lines traceable on the surface of the iris are not newly-formed vessels, but the normal veins of the part distended with blood. Sometimes the edge of the pupil is coated with lymph, but such large masses are seldom seen as accompany Syphilitic Iritis.

The vascular zone common to the other kinds of Iritis exists equally in the rheumatic form, but is less distinguishable, on account of the purplish redness pervading the whole surface of the eyeball.

The sclerotic and iris so readily sympathize, that Rheumatic Inflammation will pass gradually from one to the other; and what at first seemed a simple attack of "Sclerotitis" (or "Scleritis," as it has been termed), extends to the iris, and constitutes the disease I am now speaking of. In other cases, the iris and cornea are the chief focus of the inflammation, and there is little more in the sclerotic than the vascular zone, which, as I have said, invariably attends every form of Iritis.

By these circumstances the treatment will be regulated. If the sclerotic and cornea alone suffer, blistering to the temples is often useful, and steaming the eye over hot water. Moderate diet and avoidance of sugar are to be insisted on; the quantity of stimulants being strictly regulated according to circumstances. In one patient, moderate doses of mercury; in another, iodide of potassium, or, in delicate persons, even some form of iron, may be indicated from the first. When the more active symptoms have been subdued, there often remains a chronic affection of the sclerotic, attended with dull, aching pain in the eyeball, the temple, and all over the scalp, which is especially felt at night; and the morbid sensibility to light continues until this chronic inflammation of the sclerotic is extinct. In these cases, quinine or bark twice or thrice a day, with hyoscyamus at bed-time, usually hastens the cure. Blisters must be avoided where neuralgia exists, and if this be severe, chloroform liniment to the temple is the best application.

The mottled opacity of the cornea is, as regards vision, a still more serious *sequela* of rheumatic disease than the chronic inflammation of the sclerotic; and, if of long standing, is very difficult to remove. If, while the opacity is yet recent, a blister be applied to the temple, and a discharge kept up with savine cerate, the opaque deposit may disappear.

Local applications, in the form of washes or drops, are of little or no service in Rheumatic Inflammation. Warm water is, I think, the best thing that can be used, and poppy-heads may be boiled down to give it a pharmaceutical character, which will induce many patients to use it who would think warm water alone quite ineffectual. The traditional *vinum opii* merely irritates an already irritable part.

In what manner mercury acts upon the system, I will not venture to decide; but it so obviously controls that peculiar tendency to the effusion of lymph which accompanies the inflammatory process, that whenever this tendency is manifested in the iris mercury should be given, whether the inflammation be of syphilitic origin or not.

I may now briefly sum up what has been said concerning the symptoms of Rheumatic Iritis.

It chiefly attacks the fibrous tissues of the eye, and is always attended with pain, such as accompanies inflammation of similar structures in other parts of the body.

The phenomena are eminently those of vascular engorgement; the sclerotic exhibits a peculiar purplish-red tint, and bloodvessels become visible in the iris, where they are never seen in a state of health.

There is little tendency to effusion of lymph, as compared with the Syphilitic Inflammation; but, although poured out in small quantity, it is deposited in a situation eminently injurious to vision, namely, between the lens and the posterior surface and pupillary margin of the iris.

In the cornea there is a marked disposition to inflammatory deposit, and consequent opacity; and this frequently becomes more marked as the inflammation in the sclerotic and iris subsides.

SYPHILITIC IRITIS.

Syphilitic Iritis is frequently found in conjunction with other secondary venereal affections—such as eruptions on the skin, sore throat, and nodes. Its leading characteristic is a tendency to deposit of lymph on both surfaces of the iris and in the anterior chamber. The change of color in the iris is very well marked in the Syphilitic Inflammation, especially if the part be naturally of a bluish tint; it then assumes the green color which I have said is owing to effusion of yellow albumen into the anterior chamber.

Effusion of lymph, by uniting the capsule of the lens here and there to the margin of the pupil, causes that aperture to assume a more or less irregular and angular form. Such adhesion is termed *Synechia posterior*, to distinguish it from that which takes place between the iris and cornea, known as *Synechia anterior*.

The masses of lymph are of the most varied color, shape, and size. In some cases they are less than pins' heads; in others they occupy a considerable portion of the anterior chamber. They may be yellow, reddish, or reddish-brown, according as they are recent or of some duration, or in proportion to the number of vessels traversing them. They are usually first noticed at the margin of the pupil, and it is only in severe inflammation that similar masses are effused on other parts of the iris.*

The cornea rarely exhibits any morbid appearance beyond a slight haziness, usually limited to its lower half. When closely examined, this haze will be found to be made up of a cluster of minute dots, of a pale buff tint, as small as if pricked in with the point of a pin. In some cases, however, the cornea, throughout a severe attack of iritis, remains perfectly clear. The sclerotic presents the vascular zone, but is less injected in the rest of its extent than in Rheumatic Inflammation. There is also much less intolerance of light than in the latter form, and in some very acute cases of Syphilitic Iritis this symptom is altogether wanting. Sometimes, however, it exists to a considerable degree.

It is on *mercury* that we place our chief reliance for controlling this morbid tendency. The mode of administering this remedy will, of course, vary with the intensity of the disease, the age of the patient, and his general condition. Two grains of calomel every eight hours, with the addition of one-third of a grain of opium, is the form we may commonly employ in the more active cases, having first thoroughly cleared the bowels, if costive, with an aperient. The success of this treatment depends on its being begun at an early stage of the disease. The lymph then exists as a mere unorganized secretion, and, even if very abundant, rapidly undergoes absorption; but when it has become consolidated and traversed with bloodvessels, it yields much more slowly to medical treatment, and the pupil always remains more or less obstructed with adhesive bands, and patches of pigment deposited from the uvea.

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* We are very deficient in really good and natural representations of the earlier stages of Iritis. Sichel, pl. xiii, fig. 5, shows a well-marked case of fibrinous effusion, reddened with vessels at the edge of the pupil.

Mere soreness of the mouth must not be relied on as a guide in administering mercury. Some persons' mouths cannot be made sore by any amount of the medicine, while others are salivated with a few grains of it.

"*Salivation*" *should be carefully avoided;* the gums never being made tender except in the slightest degree; indeed, the best cures of Iritis are effected when even that point is not reached.

If the nocturnal pain be very severe, it may in some cases be relieved by the application of chloroform liniment to the temple, or else an additional quantity of opium or morphia may be added to the pill at bed-time.

As regards diet, animal food and stimulants should be very cautiously given to patients who are robust and plethoric. Sudden changes of temperature must be avoided, and the eye must be protected from strong light, if it be morbidly sensitive.

If the patient's mouth becomes tender, the mercury must be given less frequently and in smaller doses; but we must remember that lymph may be deposited in parts of the eye where we do not see it—behind the iris, or even on the optic nerve and retina; and therefore we must not leave off the medicine, merely because there is no longer any effusion visible in the anterior chamber. So long as the vascular zone exists in the sclerotic, and vision remains dim, we may be sure there is disease going on in the eye. It may assume a chronic form, and will then require a corresponding change in the treatment: the use of tonics, and a more generous kind of diet.

Those who have seen many cases of Syphilitic Iritis must have been struck with the fact, that the impairment of sight often bears but little proportion to the amount of inflammation visible in the iris itself. One patient may exhibit a large quantity of lymph on the edge of the pupil, and in its area, with considerable confusion of sight, and yet, under judicious treatment, the deposit may all become absorbed, and vision remain very little impaired. In another case the evidence of inflammation in the iris may be very slight, and may speedily disappear, and yet vision may be permanently injured to such an extent as to render the eye all but useless.

Formerly we assumed that the contrast between these two sets of cases depended upon the degree in which the retina was involved; but we had no means of demonstrating the fact. The ophthalmoscope now overcomes the difficulty, and we find that Syphilitic Inflammation, when it attacks the eye, may involve the iris actively, and affect the retina but little;—may affect the iris very slightly, and concentrate all its violence upon the retina;—or, may affect the retina almost exclusively, while the inflammatory appearances in the iris and sclerotic are so slight as wholly to escape observation.

During the acute stage of Iritis, the use of the ophthalmoscope is contra-indicated. The undilatability of the pupil, and the haziness of the media, would effectually prevent the retina being seen; while, at the same time, the glare of light would probably exasperate the inflammation. But, after the iritic inflammation has subsided, we may thoroughly examine the retina, and observe the changes it has undergone; or fix our attention upon those flaky deposits which sometimes fill the vitreous humor, and either overcloud the retina, or wholly hide it from our view. (See the Sections—*Retina; Vitreous humor.*)

It sometimes happens that Iritis comes on while the patient is under the full action of mercury for general syphilis.

In such a case the mercury may be left off, and quinine administered alone with good effect; or iodide of potassium in decoction of bark may be found of more active service. Should the patient, during his treatment for primary syphilis, have been kept on too low diet, a change in that respect will be necessary; for if, in certain states of the blood, the patient's powers be depressed below a given point, local congestions take place, and lymph is effused, constituting the phenomena of what we term "inflammation." In such cases, we may drain the patient's body of blood until farther abstraction is impossible, and yet be as far as ever from subduing the local disease.

The successful treatment of such cases consists in *choosing the right time* for giving tonics.

Syphilitic Iritis will frequently assume a *chronic* form, which is very difficult to deal with, and, if left to itself, is as destructive to vision as the acute form of the disease; for it gradually extends to the deeper textures of the eyeball, until complete disorganization of the globe takes place. When this chronic form of the disease attacks patients suffering from the tertiary forms of syphilis (after having been, perhaps, debilitated by a long course of mercury), they are sometimes improved, to a surprising degree, by the careful administration of iron.

In some patients, after all traces of syphilis appear to have been eradicated, the eyes still retain a susceptibility to inflammation, which manifests itself upon any accidental exposure to cold or wet. A case of this recurrent form which came under my own observation, is sufficiently remarkable to be related.

Henry H——, aged thirty-nine, married, came to me on the 6th of May, 1845, with Iritis in the *left* eye. The iris was of a dirty green color, the pupil irregular, the vascular zone in the sclerotic well marked. There was much pain in the globe and around the orbits at night. He was purged, and then took calomel with opium every eight hours, till his mouth became tender, and afterwards less frequently. He steadily improved, and was dismissed on the 17th of June.

On the 2d of December he returned, with the *right* eye attacked just as the left had been. A somewhat similar treatment to that previously employed cured him in about three weeks.

On the 14th of April, 1846, the *left* eye was again attacked, and more severely than before, lymph being poured out in considerable quantity, so as to produce the appearance termed *Hypopyon*. The disease, however, yielded rapidly to treatment; and he was dismissed at the end of a fortnight.

On the 26th of November, in the same year, he applied for the fourth time, having Iritis in the *right* eye. I examined the left, which I had twice seen so much inflamed, and found scarcely a trace of disease. The natural gray color and fibrous texture of the part were restored, and the pupil contracted, though not very briskly, when exposed to light. This fourth attack yielded to the same kind of treatment which had been adopted before, and within ten days the eye looked well; but I kept him for some time in attendance, giving him a grain of calomel at night, and two grains of quinine twice a day.

The patient declared his eyes had been bad twice a year,—"spring and fall," as he expressed it,—for the last twenty years! He readily confessed that the complaint began as a secondary symptom of syphilis, but assured me he had never had the primary disease again during the period mentioned.

Whether all the periodical attacks he described were those of *Iritis*, it is impossible to say; probably some of them merely involved the sclerotic; but the regular alternation of disease I had *four times* the opportunity of watching is very remarkable, as is also the complete recovery of the healthy aspect of the iris after each attack, and the good vision the patient enjoyed in the intervals.

The efficacy of *Turpentine* in Iritis was strongly urged some years ago by CARMICHAEL, of Dublin. He by no means proposed it as a substitute for mercury on ordinary occasions, but only as useful in those cases where, from extreme debility of the patient, mercury might be injurious. In such cases more benefit is, I think, likely to result from quinine, in combination, perhaps, with small doses of mercury, the patient's strength, meantime, being sustained by a liberal diet.

The only cases in which I have myself found turpentine beneficial, have been those of a rheumatic character, with visible enlargement of the vessels of the iris, the characteristic sclerotic redness, and tenderness of the globe, but without any marked tendency to the effusion of fibrine into the anterior chamber. I wish I could point out some guiding sign by which it could be determined that a given case of this peculiar form of Iritis would be benefited by turpentine; but I cannot. I can only say from experience, that now and then I have met with a case in which mercury seemed to do harm, and quinine no good; but where Chian turpentine, in five-grain doses, three or four times a day, effected a cure. In other cases, which seem of the same kind, I have found the turpentine apparently useless.

SYPHILITIC IRITIS IN INFANTS.

Among the vast number of infants affected with hereditary syphilis, we see but a few in whom the iris becomes the seat of disease. Mr. HUTCHINSON, whose industry and acuteness of observation have brought together so many cases of infantile Iritis, sums up his remarks as follows: "There can be no difficulty in admitting that it is among the rarest of the symptoms of hereditary syphilis. I am sure, however, that it often escapes notice. The absence of the sclerotic zone, and the very small amount of local symptoms which it causes, taken with the fact that young infants usually keep their eyes shut, will account for this."*

It is usually between the second and tenth month that the infant is attacked with copper-colored eruptions; sometimes also with mucous tubercles about the genitals, aphthæ in the mouth, and "snuffles." The eyelashes fall off, and sometimes the nails also. The general aspect of the child is puny and stunted, but I have seen some cases that were marked exceptions to this rule. The red zone in the sclerotic, that unfailing accompaniment of Iritis in the adult, is always very slight in the infantile form, and in some cases can hardly be traced. The lymph is sometimes scattered over the iris in small isolated granules, but more frequently flows down to the bottom of the anterior chamber, either presenting the appearance termed *Hypopyon*, or massed together into a more solid nodular form. The iris becomes dusky, the pupil irregular, and sometimes obscured by the turbidity of the aqueous humor.

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* Clinical Memoir, &c., 1863, p. 23.

Treatment.—To sustain the vital powers of the infant is of primary importance, and one brought up by hand has but a poor chance of recovery if the Iritis is severe. Four or five minims of Battley's liquor cinchonæ twice a day in a little milk is often of great service.

Mercury, however, should be given without delay. Hydrarg. c. creta is such an uncertain preparation, that I always prefer giving calomel, and the precision with which one can regulate its doses, makes me employ it in preference to mercurial inunction. A quarter of a grain or half a grain of calomel may be given morning and evening, the dose being gradually lessened in proportion as the lymph disappears from the eye; several weeks usually elapse before the mercury can be wholly discontinued.

Atropine is so powerful a poison, even in the diluted form in which it is externally applied, that in delicate infants it is well not to use more than is absolutely necessary to promote dilatation of the pupil. It is enough to put into the eye, once a day, one or two drops of a solution containing two grains of the sulphate of atropia in an ounce of water.

SCROFULOUS IRITIS.

When the last edition of this volume was published, I spoke hesitatingly about the occurrence of Iritis as a manifestation of scrofula. I have since observed several cases which I could not hesitate to consider of that nature. The patients have been from five to fifteen years old, and more or less affected with swelling of the cervical glands. The chief difference between the appearance of the iris in these cases, as compared with syphilitic ones, was, that in the scrofulous cases the part appeared to be more generally infiltrated with inflammatory deposit, so that, instead of this appearing wholly or chiefly about the edge of the pupil, it either accumulated about the junction of the iris with the cornea, or thickened and bulged forward the whole substance of the iris, the veins of which became full and turgid, occasionally giving way, and allowing their blood to settle down to the bottom of the anterior chamber.

Treatment.—The general health demands the utmost attention in this form of scrofulous disease. Nutritious diet and pure air are of the [illegible]. To shut up the patient in a [illegible] npairing the general health, is likely to accelerate the loss of the eye. Violent purgatives are to be avoided, and the bowels relieved, when necessary, by mild aperients. Small doses of calomel, a grain or so at night, should be given when there is a tendency to deposit of lymph in the pupil. Bark is often at the same time requisite as a tonic, or cod-liver oil may be preferable when there is debility and wasting. Iodide of iron is very useful in those cases where the veins of the iris are turgid, and there is great infiltration of its tissue.

Atropine is the only local application likely to be of service. All irritating drops and lotions must be strictly avoided.

"GONORRHŒAL" AND "ARTHRITIC" IRITIS.

Ophthalmic writers of credit and experience have described a "Gonorrhœal Iritis," but I have never seen an inflammation of the iris which I could trace as a consequence of mere urethral discharge, unmixed with syphilis.

Another form of Iritis is mentioned by some ophthalmic authors (especially the Germans) as the "Arthritic." A peculiar ash-colored ring, intervening between the vascular zone in the sclerotic and the edge of the cornea, a transversely oval pupil, and a purple tint of the enlarged veins of the globe, are the chief signs which these writers insist upon as diagnostic of the Gouty Inflammation.

I cannot recollect ever to have seen a case of true *Iritis* which I could distinctly trace to a gouty origin; and the appearances I have enumerated, as assigned to "Arthritic Iritis," are certainly found in patients who have never had the slightest symptom of gout in other parts of the body.

INJURIES OF THE IRIS.

Foreign Bodies.—These cannot of course reach the iris without having first penetrated the cornea or sclerotic; much more frequently they penetrate the former.

I have already spoken of the appearances which wounds of the cornea present; I would now allude only to those accidents where the injury to that structure is so slight as to be of no importance, but where the presence of a foreign body in the iris is the real source from which danger may be apprehended.

If a case of this kind is seen immediately after the receipt of the injury, there may be, perhaps, little or no difficulty in recognizing the foreign body impacted in the iris, especially if it be a fragment of *bright* metal. But if some days or weeks have elapsed since the accident, Iritis may have set in, and the fragment have already become invested with a covering of adhesive matter, so as very closely to resemble one of the effusions so characteristic of Syphilitic Iritis.

To extract a minute foreign body from the iris, without inflicting further injury on that part, or on the lens, is at all times a work of extreme delicacy. It is, of course, a much easier task when the fragment is situated near the ciliary margin of the iris, than when close to the pupil. A fine "cannula-forceps," introduced through a small opening at the outer edge of the cornea, will, in most cases of the latter kind, be found the best and safest instrument. But if the foreign body be of any considerable size, the delicate cannula-forceps will be useless, and may be broken in the attempt to grasp the fragment. ASSALINI's spring-forceps will then be preferable. A speculum, to separate the lids, and a forceps, to steady the globe by nipping up a piece of the conjunctiva, are almost indispensable.

I would caution the young practitioner against believing that fragments of metal impacted in the iris will, if let alone, "become oxidized and absorbed," or encysted with lymph, and so rendered forever harmless. Whatever changes iron may occasionally undergo, chips of copper and brass will remain for years in the iris without apparent diminution of bulk: and although they may for a time become coated with lymph, even that will not secure the patient from repeated attacks of inflammation, which will eventually destroy the eye. It seems that long after the foreign body has become invested by a cyst-like covering, suppuration may occur within the latter, and the fragment become once more denuded; it may then either fall down into the anterior chamber, or be thrust forward against the hinder face of the cornea by successive deposits of exudation. In the latter case the cornea ulcerates, and the foreign body may thus be expelled from the eye.*

Wounds.—One of the most frequent consists in a partial separation of the iris from the ciliary ligament, the result of blows, sometimes comparatively slight ones, such as are inflicted by the rebound of a twig, the lash of a whip, &c. The appearances presented by this accident are, of course, very various, according to the extent to which the separation has occurred. Sometimes the secondary pupil so produced is not larger than a pin's head, and from its position may be overlooked by a superficial or careless observer. When the laceration is more extensive, involving, perhaps, a third or the half of the ciliary margin of the iris, there is always some effusion of blood into the anterior chamber, and the form of the natural pupil is altered by the relaxation of that part of its border which is nearest to the laceration. In some cases of extensive detachment, the margin of the pupil falls together, so that its aperture is wholly obliterated.†

The margin of the iris, when once torn from its ciliary attachment, never returns to it again; and vision remains much impaired, even although the lens may have escaped injury.

The *Treatment* should be of the simplest kind. Protection of the eye from light, and occasional fomentations, comprise nearly all that is required

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[*] See page 140.

[†] Figures of this accident, in various stages of separation, may be found in Mackenzie's work, fourth edition, pp. 396-7.

locally. As regards general treatment, no fixed rules can be laid down—many patients requiring no medicines at all; while others, of a more irritable nature, may need narcotics for the first few nights after the injury. Provided the patient's general vigor be good, the blood effused into the anterior chamber soon becomes absorbed. Mercury, which is often given in these cases, in no wise hastens the absorption.

Foreign bodies which, after traversing the cornea, have penetrated deeply into the eye, so as to lodge themselves in the lens or vitreous chamber, sometimes penetrate the iris on their way. In such cases, the wound of the iris is the least important part of the accident, the more serious effects of which will be noticed under the head of "Injuries of the Lens." If the foreign body is small—a shot, for instance—and projected with great swiftness, the wound of the iris gapes but little, and may even be hardly discernible. The same remark applies to those chips of metal which pass through the iris in the course of its fibres; when, however, these are divided transversely, the wound gapes, and forms a secondary pupil.

The uncertainty as to where the foreign body has lodged, will induce the surgeon to give an unfavorable prognosis in all cases where he finds a recent wound of the cornea associated with one of the iris, and learns that the injury has been inflicted by some small body projected against the eye.

MORBID GROWTHS ON THE IRIS.

In most of the cases described by the older ophthalmic writers, as exhibiting "excrescences," "tubercles," "tumors," and so forth, on the iris, the morbid appearances seem to have been produced by the part becoming gradually involved in malignant or scrofulous deposits, which had advanced from the interior of the globe; or else the fibrinous effusions of Iritis had been mistaken for permanent tumors.

I have, however, seen three or four cases in which rounded masses, very vascular, and resembling encephaloid deposit, seemed to have originated in the tissue of the iris itself. In one of these cases, still under observation, the mass extends from the outer margin of the iris to the edge of the pupil. The iris itself looks healthy throughout, and vision is excellent. I first saw the case nearly three years ago, and as yet there is no trace of irritation set up in any part of the eye. In another patient, a growth of perfectly similar appearance had existed for several years without giving rise to inflammation. Latterly it has increased so as to press against the cornea, and great irritation of the eyeball is setting in.

A more common, although still rare, form of morbid growth from the iris is that of cysts, apparently developed within its substance, and gradually encroaching upon the anterior chamber. These cysts are usually of slow formation, and at first are not attended with much uneasiness; but as they increase they give rise to pain. When small, they resemble a good deal those *pouches* of the iris which are met with where complete adhesion of the pupillary margin to the capsule of the lens has occurred, and where the fluid secreted by the posterior chamber of the aqueous humor, being unable to pass through the pupil into the anterior chamber, pushes the iris forward till it almost touches the cornea.

The best mode of treating cysts of the iris, seems to be to puncture them repeatedly with a rather broad needle, introduced through the cornea.

CHAPTER VIII.

THE CHOROID AND RETINA.

"CHOROIDITIS"—"RETINITIS"—"AMAUROSIS"—"AMBLYOPIA."

THE Ophthalmoscope has effected such a revolution in the opinions formely entertained as to the morbid conditions of the choroid and retina, that the terms at the head of this chapter have already lost much of the meaning they would have suggested a few years ago; and many cases, which then were vaguely spoken of as "functional Amaurosis," could now be shown to depend upon visible changes of structure.

OPHTHALMOSCOPIC APPEARANCES OF RETINA AND CHOROID.

Cases of defective sight, in which no disease could be detected in the cornea, iris, lens, or capsule, were formerly beyond the limits of positive diagnosis. The hinder surface of the lens formed, as it were, the boundary between the accessible and the inaccessible regions of the eye, and all beyond was enveloped in doubt and mystery. The Ophthalmoscope, in laying open to our inspection the retina and choroid, at once completely revolutionized our notions as to the morbid changes of those parts, and we soon discovered the elaborate descriptions of "Choroiditis" and "Retinitis," handed down to us by writers of the præ-ophthalmoscopic period, to be mere fancy pictures, wholly unlike the unseen originals.

Duly to illustrate all the appearances which the optic nerve, retina, and choroid assume, an extensive series of carefully executed colored drawings would be required; and in the absence of these, I can present but a meagre, and, I fear, hardly intelligible verbal sketch of some of the more striking characteristics of the deep tissues in health and in disease. In place of original illustrations, I must refer my reader to those he will find in the more accessible published works; especially in the very beautiful Atlas der Ophthalmoskopie of LIEBREICH; Berlin, 1863.

Unless the pupil be morbidly dilated, it is, of course, necessary to apply atropine before using the ophthalmoscope.

The following are some of the ordinary appearances presented by a healthy eye.

Retina and Optic Nerve.—When describing the mode of using the ophthalmoscope (Chap. II), I very briefly alluded to the color presented by the retina; but it is impossible to indicate any precise tint which may uniformly be regarded as indicating its healthy condition. In pale, anæmic persons it may be almost of a buff color, and in those who are full-blooded it may exhibit a considerable amount of redness, and yet in both cases its vascular supply may be only in due proportion to that of other parts of the body. Practice alone can teach the observer what amount of vascular injection is compatible with healthy action of the various nervous tissues.

The variations of color in the fundus of the eye very much depends also upon the general complexion of the patient. In fair persons, with light hair and gray irides, the quantity of pigment between the meshes of the choroidal vessels is very small; while in those with dark hair and brown irides, and a swarthy skin, it is abundant; and in the colored races of mankind, the pigment is so plentiful that the fundus assumes a dusky, brownish tint, on which the optic nerve appears as a clear white disk, while the choroidal vessels also offer a striking contrast to the dark ground on which they lie.

The true retina is transparent, or nearly so; and when the layer of epithelium interposed between it and the choroid is sparingly developed, the individual vessels of the latter are plainly seen; whereas, if the epithelial layer be dense, the choroid appears through the retina only just enough to produce the effect of a generally diffused reddish tint.*

When, in addition to a sparing epithelial layer, the pigment of the choroid is also little developed, the choroidal vessels are distinctly seen ramifying on the almost white surface of the sclerotic;† while with a similar condition of epithelium and abundant choroidal pigment, the red vessels of the choroid appear as if standing out from a black ground.*

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* Liebreich; Tab. ii, fig. 1.

† Liebreich; Tab. ii, fig. 2.

The axis of vision does not correspond to the optic nerve, so that, when the examined eye is directed straight forward, towards the observer's forehead, for instance, the portion of retina in the middle of the field of view is that where the macula lutea, or yellow spot, is situated. It is difficult to see the spot itself, but its situation is recognizable from its intermediate neighborhood being almost destitute of the long vessels so visible at other parts of the retina. They arch above and below the yellow spots, but do not cross it.†

To exhibit the optic nerve, the patient must turn the eye a little inwards, directing the right eye, for instance, over the observer's right shoulder, and *vice versâ*. The nerve then appears as a round, whitish patch, from which the central vessels emerge and radiate towards the periphery of the retina. I speak of the nerve as round, but slight deviations from that exact figure are quite compatible with its healthy functions, as are also slight varieties of color. It should not be of a dead white, but very faintly tinged with pink. This tinge is less perceptible in old subjects, in whom also the nerve sometimes deviates very perceptibly from the round form. As the central artery and vein are emerging from the nerve, each vessel divides into an upper and a lower branch, and then again subdivides, while spreading over the retinal surface. In old persons they are sometimes very tortuous at their point of emergence, so as to cover a considerable portion of the optic nerve.

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* Liebreich; Tab. ii, fig. 3.

† Liebreich (Tab. ii, fig. 1) gives a highly finished representation of the macula lutea, as seen by him in a magnified view of the fundus. I have myself never succeeded in discerning it as plainly as he here represents it.

A very little practice will enable the student to distinguish between the retinal arteries and veins. The former are smaller in size, of a lighter red than the latter, and have a distinct double outline; while the veins, besides being larger, are of a more purple color. If firm pressure be made on the globe with the finger, both sets of vessels may be seen to pulsate.

Choroid.—The choroidal vessels are considerably larger than even the main branches supplying the retina, and are closely packed together in a somewhat parallel arrangement, leaving very narrow interspaces, in which the dark, deep-seated pigment is deposited. Sometimes the choroidal vessels are so plainly seen, that the observer almost forgets he is looking at them through the whole thickness of the retina. More commonly they are dimly traceable, as through a minutely granulated and reddish film; while, in other cases, they are wholly invisible. The causes of these variations I have above alluded to, when speaking of the retina.

The layer of epithelium between the choroid and retina becomes more sparing as age advances, so that in old persons the choroidal vessels appear with extreme brilliancy and distinctness. They are, however, in old age very often much less red than in earlier life.*

MORBID APPEARANCES OF THE OPTIC NERVE, RETINA, AND CHOROID.

Optic Nerve.—We now and then see a thin, jet-black crescentic line skirting the margin of the nerve, and involving a sixth, a quarter, or even the half of its circumference. This is said to be nothing more than the edge of the choroidal aperture, through which the optic nerve passes, which becomes visible in consequence of the fibres of the nerve passing off in an oblique direction. This black line is seen in eyes free from any defect of sight.

I have already (Chap. I) spoken of the remarkable white patch skirting the optic nerve in patients affected with Myopia. I am not aware that the fact of its not existing in *young* persons so affected has been noticed by ophthalmic writers.

The optic nerve may be pale and *anœmic*, or it may be *hyperœmic*, and reddened throughout its whole area, and both appearances may pass off under suitable treatment; but the condition termed "white atrophy" is one of an altogether hopeless character. In the worst form of this disease the retina is congested throughout, and its long radiating vessels are almost lost in one uniform, dark-red ground-tint, on which the strongly defined optic nerve, of a chalky whiteness, stands out in bright contrast. The artery and vein, as they emerge from the disk, are sometimes mere fine threads, hardly recognizable as bloodvessels. This form of white atrophy is more or less connected with chronic brain-disease, and even perception of light is often wanting. In less severe cases the vessels of the choroid and retina are all traceable, but the veins of the latter are too large in proportion to the arteries, and the optic nerve, although not exhibiting the blank, chalky whiteness of extreme atrophy, is either of a pale gray tint, or of a creamy whiteness; in either case devoid of all the delicate half-tints that characterize healthy nervous tissue. In this state the eye may still retain the power of perceiving large objects.

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* Liebreich; op. cit. Tab. ii, figs. 2 and 3.

There is a more aggravated form of gray atrophy, in which the optic nerve is at the same time cupped, and the emerging vessels are in consequence more or less distorted. These cases were formerly confounded with Glaucoma, but from the latter they are distinguished by an absence of the intermittent obscurations of sight, and of all inflammatory signs. Steadily progressive dimness of sight is the symptom of this chronic gray atrophy.

In the chapter on Glaucoma I shall speak of the remarkable appearance which the optic nerve offers in the earlier stages of that disease. I say the earlier stages, because, when the outburst of acute glaucomatous inflammation takes place, the

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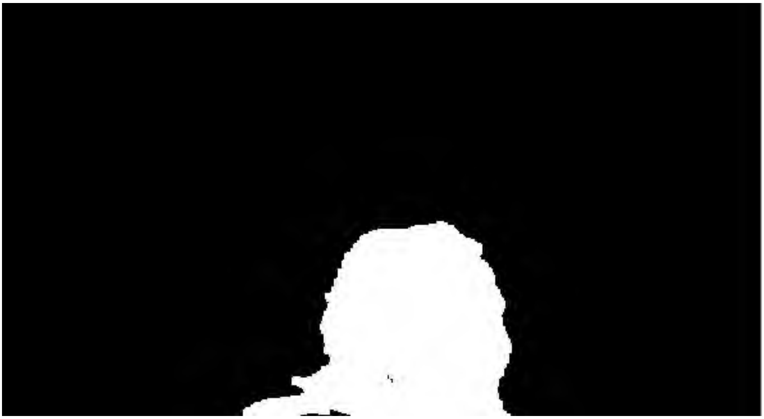

details of the fundus cannot be seen, a dull red reflex being alone visible with the ophthalmoscope. At the same time that the optic nerve appears concave or cupped, its color becomes changed to a dirty gray, and the vessels, instead of at once passing off towards the periphery of the retina, wind over the edge of the depressed nerve-disk.*

Hyperæmia followed by atrophy of the optic nerve has been described as a result of tobacco smoking. This "social evil" at the present day is so common, and the dim-sighted patients with hyperæmic optic nerves are comparatively so few, that we must be very cautious in admitting the tobacco and the defect of sight to stand in causal relation to each other. There can, I think, be no doubt that, however innocuous this vegetable poison may in time become to those who smoke it, its effects upon the general nervous system of boys and young men are very marked, and very injurious; and it is therefore in the optic nerves of ular figure, and appearing to be twice its natural size. In these cases, however, the real tissue of the nerve is not seen at all, being overlaid by an opaque whitish patch of old deposit, extending considerably beyond its margin. The central vessels are usually much diminished in size, as if compressed by the shrinking of the deposit in which they are embedded at their point of emergence. According to the amount of infiltration of lymph, the defect of vision in these syphilitic cases may vary from a slight general mistiness to mere perception of large objects.

Large white patches, of irregular form, edged with scattered masses of black pigment, are also attributed to old syphilitic disease, and are supposed to consist of inflammatory deposits upon the choroid.* Such deposits would be distinguished from those in the substance of the retina itself by the long retinal vessels passing unchanged across the area of the former.

One of the most startling revelations of the ophthalmoscope consists in the enormous extent to which *deposits of pigment* occur on the surface of the retina, without any external signs of ocular disease. The entire surface may be blotched over with black lines, dots, and patches of every variety of form and size, so that hardly a trace of healthy retina can be seen, and yet the patient may never have been sensible of any symptoms of acute or chronic inflammation; and the loss of sight in the affected eye may have been first discovered on accidentally closing the sound one. The term "Retinitis pigmentosa" has been given to the inflammatory process of which these deposits of pigment are the result.*

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* Liebreich; Tab. iv, fig. 1. Smaller patches in the choroid are shown in fig. 2.

The dark-colored patches resulting from *old extravasations of blood* into the substance of the retina commonly involve a less extent of its surface than the pigmentous blotches I have just been describing; and if the hemorrhage, and consequent breaking up of nervous tissue, be of old standing, a pale brown or dusky gray patch may be the only trace of the injury. The patches of pigment are of a deep black, and commonly, as I have said, are distributed over a large extent of the retina; the results of hemorrhage are more frequently limited to one spot, which may be situated at any part of the retina. The real nature of the blotch resulting from hemorrhage may sometimes be ascertained by the manner in which one of the large radiating vessels of the retina—the original source of the bleeding—is seen to end abruptly at the edge of the dusky patch. This aid to diagnosis would of course be wanting where the hemorrhage had come from the choroid.

Recent extravasations of blood upon the surface of the retina assume the most varied appearances: sometimes several small red blotches occur in the course of some vessel; in other cases, one large clot is seen overspreading the greater part of the retina. Occasionally, when the extravasation is of small extent, the very spot is indicated by a little smear of blood close at the side of the ruptured vessel. I have several times seen such extravasations within a few hours of their occurrence. When hemorrhage results from a violent blow on the eye, the vitreous humor often suffers at the same time, and then the clots float about in that fluid at every movement of the eyeball. Patients affected with albuminuria, with or without extensive degeneration of the kidney, are liable to deposits on the retina, chiefly on and around the optic nerve. At the same time, numerous small extravasations of blood occur from the retinal vessels. At a later stage of the disease small white dots, of a fatty nature, are found in groups on the retina.* LIEBREICH† has described and figured a case in which sudden and total blindness occurred, and where the ophthalmoscope revealed an extensive infiltration of the retina immediately around the macula lutea, the spot itself appearing as a vivid red dot in the midst of cloudy whiteness. The retinal arteries were empty, and LIEBREICH referred the symptoms to embolism having taken place in the central artery. A similar case is related by SCHWEIGGER.‡ The patient died eighteen months afterwards, and SCHWEIGGER found a clot still plugging the arteria centralis retinæ.

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* Liebreich; Tab. vi, fig. 1.

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* Liebreich; Tab. ix, fig. 1, shows a recent case, fig. 2 an old one, of this kind.

† Op. cit.; Tab. viii, fig. 4.

‡ Schweigger (Gebrauch des Augenspiegels); 1864. Tab. iii, fig. 10.

One would naturally suppose that *serous effusion between the retina and choroid* could only result from inflammation so well marked as inevitably to attract the patient's attention; but, in the revelations of the ophthalmoscope, there is nothing more curious than the fact, that extensive separation of the retina from the choroid, involving even half their surfaces, may go on without any of those phenomena of flashes and pain which stand recorded in our præ-ophthalmoscopic text-books as invariably accompanying so-called "Retinitis" and "Choroiditis."

A patient, for instance, finds the sight of one eye failing, until, perhaps, half of its field of vision becomes a total blank. No phenomena of inflammation are observed; nothing, in short, but defect of sight; and yet, when we examine the eye with the ophthalmoscope, we find a considerable portion of the retina detached from its connections, and forming a rounded projection into the vitreous humor.

Effusions beneath the retina, if small, are often very difficult of detection with the ophthalmoscope. They appear at first like cloudy portions of the retina, across which the radiating vessels can no longer be traced in their regular order. Of course that part of the retina which still retains its position, and that which is displaced, cannot be in focus at the same time. When the displaced retina projects so much as to involve the greater part of the patient's field of vision, the contrast between the reddish reflection from the healthier portion, and the opaque, dark-colored, lobe-like projection of that which is displaced, is very remarkable.

When nearly the whole of the retina is separated from the choroid by effused fluid, the ophthalmoscopic appearances are sometimes very puzzling, in consequence of the oscillations imparted to the loosened retina by every slight movement of the eye. At one moment the fundus appears of a dull gray; then the optic nerve suddenly presents for a moment its white surface; and then again some vessel of the illuminated retina comes clearly into view, and as quickly disappears. These glimpses are often rendered still more confused by the existence of floating bodies in the vitreous humor. When the subretinal effusion has reached its utmost extent, the vessels of the retina, tortuous and enlarged, are seen mounting over the summit of the oscillating mass.*

The development of *Cysticerci* in the human eye is an extremely rare occurrence. Very few cases have been seen in the British Islands, as compared with those reported from Germany;† and this may be accounted for by the greater prevalence of tapeworm in the latter country. For, strange as the statement may appear, it is a fact that the *cysti-*

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* Liebreich; Tab. vii, fig. 2.

† Eighteen cases from the Archiv für Ophthalmologie, sixteen of them under Græfe, were quoted in the last edition of this volume. Add two cases in the same journal by Jacobson; xi, p. 147: case by Bowman; Ophth. Hosp. Reports; vol. iii, p. 324: case examined by Hulke: in all four cases the entozoon was between choroid and retina.

cercus and the *tænia* are but the same creature in different stages of development.

I have already noticed the presence of cysticerci beneath the conjunctiva;* they have been found in the anterior chamber,† between the retina and choroid, and floating in the vitreous humor, having reached the last-named situation by perforating the retina. The appearance of a cysticercus, while still placed between the choroid and the retina, and after its escape into vitreous humor, is well depicted in a plate by LIEBREICH.‡

Choroid.—This tissue and the retina lie so closely together that, for the most part, their morbid changes cannot be separately examined or considered. Thus, when speaking of the retina, I have already alluded to the white patches of deposit which are seen upon the choroid as a result of inflammation,§ and are proved to be seated in that tissue by the fact of long retinal vessels being visible as passing unchanged across them. I have also, when speaking of Myopia, described the deficiency of choroidal tissue which gives origin to the white "myopic patch," situated close to the optic nerve.

As might be expected, from the great size of the vessels of the choroid, the extravasations of blood which result from their rupture are often very large, and after the effused blood has become absorbed, the broken-up choroidal tissue is absorbed likewise, so that the sclerotic is exposed, and there results a large white patch, fringed with an irregular edging of black pigment.

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* P. 89.

† Mackenzie; fourth edition, p. 1089; six cases. Windsor; Ophth. Hosp. Reports; vol. iii, p. 322.

‡ Tab. vii, figs. 5, 6. Besides the cases above quoted from the Archiv, see a case by Desmarres, Maladies des Yeux, 1858, vol. iii, p. 756. Williams; Cincinnati Lancet, May, 1858.

§ Liebreich; Tab. iv; large patches of deposit, of syphilitic origin, are seen in fig. 1; smaller deposits from the same cause at fig. 2.

In some cases several vessels give way at the same time, or at short intervals, and then nearly the whole surface of the choroid may exhibit a very variegated appearance, due to the presence of several white patches of various sizes, edged with black, intermixed with entirely black spots of pigment, and mottled red blotches, formed of still unbroken groups of bloodvessels.

Treatment.—The limits I have prescribed to myself, in writing this volume, render it altogether impossible for me to enter into details as to the treatment required in the manifold diseases of the optic nerve, retina, and choroid, which exhibit the various ophthalmoscopic appearances I have briefly noticed. Previous to the invention of the ophthalmoscope, these diseases were all vaguely included under the terms *Amaurosis* and *Amblyopia*, and, in utter ignorance of the structural changes on which the symptoms thus designated really depended, oculists devised fanciful hypotheses, which the ophthalmoscope now shows us to have been utterly erroneous. The indiscriminate praises of bleeding, of mercury, of strychnine, &c., in cases of so-called "Amaurosis," may now be consigned to oblivion, and with them a term which has lost all practical significance.

It is evident that the treatment in retinal and choroidal diseases must be of the most varied kind. When syphilis is the cause of deposits of lymph, either on the surface of the optic nerve and retina, or on the choroid, the judicious employment of mercury or iodine is often of great service. Hyperæmic and anæmic states of these structures are only to be properly treated by well considering the whole condition of the patient's system, and not by any merely local means. Extravasation of blood will require very different treatment, and the prognosis will also greatly vary, according to the circumstances under which they may have taken place. Superficial effusions from the retinal vessels, even when of considerable extent, on becoming absorbed, leave only slight traces, so far as sight is concerned; while those from the choroid frequently so break up and damage the superjacent portion of the retina, that their site ever afterwards remains a perfect blank in the patient's field of vision. Even very small apoplexies, however, will cause great and lasting injury to sight, if they take place at or near to the yellow spot.

Retinal and choroidal apoplexies by no means occur exclusively, or even chiefly, in robust and plethoric subjects, or during violent efforts. They take place in those who are pallid and feeble, and often at times of perfect bodily repose. In the latter class of patients, tonics and stimulants will be as necessary as a system of moderation or even abstinence will be in patients of an opposite character. The effusion and apoplexies attending albuminuria can, of course, be properly treated only by bearing in mind the primary derangement of the renal system.

After all the invaluable aid from the ophthalmoscope towards the explanation of otherwise obscure forms of defective sight, many cases must still remain, in which the most careful exploration affords us merely a negative result. We may feel sure that the blindness is not caused by any change in the tissues of the eye; but to determine its true origin may tax all our resources of pathological induction.

In children, blindness coming on without apparent disease in the eyes themselves, would suggest the presence of *Tubercle* in the brain. The occurrence of fits or paralysis would strengthen this supicion; although blindness may for a long time be the only manifestation of tubercular affection.

During the progress of *Hydrocephalus*, loss of sight invariably takes place; and in the latter stages of this disease the pupils become dilated to their fullest extent, and quite immovable.

We know that a sudden change in the supply of blood to the brain may produce partial or total loss of vision. This is made familiar to us by what we see in cerebral concussion, and in the first stage
ordinary syncope. The effect of *gastric* and *in-*
nal irritation in disturbing the function of the

retina is well known; although the mode in which the effect is produced is not easy to comprehend.

Exposure to intense light, or *blows on the eyeball*, may cause a temporary blindness, which, in the course of a few hours, may wholly pass away; and not be followed by inflammation, or, indeed, by any symptoms requiring treatment.

There is, however, one remarkable form of intermittent blindness, which persists for a period sufficiently long to demand the surgeon's attention. It is termed *Hemeralopia*, from the patient being able to see only in broad daylight, and becoming totally blind as soon as the sun has set. The only persons I have myself seen affected with this conplaint, have been those just returned from sea-voyages—most commonly from the East or West Indies—and who have consequently been exposed to a strong glare of sunlight. The affection is, I believe, also met with among the inhabitants of the inland parts of India, who attribute it, just as our own sailors do, to sleeping when exposed to the moonbeams.

The real cause of Hemeralopia appears to be exhaustion of the nervous susceptibility of the retina, from overexcitement by the sun's rays, whereby the part is rendered incapable of appreciating the milder rays of twilight or moonlight.

But this exposure to strong light is not always the cause of the affection; for I have met with it among those who had never quitted the temperate parts of the globe. In most of the latter cases, however, the complaint has shown itself after voyages which had subjected the patients to exhausting labor, and exposure to severe weather, when deprived of their proper supply of fresh provisions and vegetables.

I have commonly found that a few weeks' residence on shore, with a wholesome *mixed* diet, and the use of quinine, has restored their vision to a healthy state.

We find *Nyctalopia* mentioned in books, as a disease the very reverse of *Hemeralopia ;* characterized by an *inability to see by daylight.* I have certainly never met with this affection ; and am inclined to think it altogether an imaginary one, invented, as it were, as a companion disease to balance the Hemeralopia I have just been speaking of.

INABILITY TO DISTINGUISH CERTAIN COLORS.*

(*Acritochromacy.*)

The defect upon which this strange congenital peculiarity depends, is probably, situated—not in

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* Ophthalmic writers have exerted their ingenuity to devise a suitable Greek (or Greek-like) name for this condition. The following list comprises some of their combinations : Achromatopsia, Chromato-pseudopsia, Chromato-metablepsia, Chromato-dysopsia, Chromato-pseudoblepsia, Dyschromatopsia. Most of them, independently of their uncouthness, are objectionable,—like the term *color-blindness,* —as implying difficulty or inability to *see colors ;* whereas the real defect in question is inability to *discriminate* between *certain* colors. I have added to the list, as a suggestion, the word Acritochromacy (*Ακρῖτοχρωματία*) ; it supplies the meaning we are in want of, and is tolerably pronounceable. It admits also of a good adjectival form,—Acritochromatic.

Of all the unfortunate inventions of pathological nomenclature, the

the eye itself, but in that portion of the brain to which the impressions of light are ultimately conveyed. A very interesting case I had under my care would seem to confirm this view.

A remarkably intelligent little girl was suddenly attacked with dimness of vision, which, within a few hours, amounted to almost total blindness. The cause was evidently referable to disordered circulation in the brain. For some time after the patient had perfectly recovered the power of distinguishing minute objects, so as even to read small type, she used to confound red, and its compounds, with their complementary colors.

I have just said that this inability to distinguish certain colors is congenital, and I need not add wholly incurable. It is most important that its occasional occurrence in persons whose acuteness of sight is quite perfect as regards form should be generally known, for on many occasions our lives may depend upon the ability of some solitary signal-man to distinguish between green, the sign of safety, and red, that of danger. Now that a

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word Daltonism, as applied to this functional defect, seems to me one of the worst. The late eminent chemist, Dalton, was to a remarkable degree, deficient in the power of discriminating between certain colors, and he published his own case in the Memoirs of the Literary and Philosophical Society of Manchester, for the year 1798 (vol. v, p. 28). But it seems an indignity to the memory of such a man to connect his name in this way with a mere physical defect. We would surely wish to remember our great men for their mental excellences, not for their bodily imperfections; for those endowments whereby they surpassed others, not for the infirmities shared in common with them. Dalton should be immortalized as the propounder of the "atomic theory," not as the man who mistook red for blue.

universal railway system has forced upon us a mode of travelling fraught with incessant peril to life and limb, we cannot afford to neglect a single chance of safety.

The reader will find much information on this subject in some papers by Dr. WILSON, "On Chromato-pseudopsia, or Color-Blindness," published in the Monthly Journal of Medical Science, 1854.

CHAPTER IX.

THE VITREOUS BODY.

PREVIOUS to the invention of the ophthalmoscope, we had but little opportunity of appreciating the changes to which the vitreous body is liable: a loss of its natural consistency, however, was known to occur in many cases of chronic inflammation of the deeper tissues, as evidenced by the peculiar soft, doughy feel communicated to the finger, so different from the firm, resistent elasticity of a healthy globe.

The term *Synchysis* is applied to that fluid condition of the vitreous body which results from the disintegration of the delicate membranes traversing it; and there is a singular variety of it, known as "Sparkling Synchysis" (*Synchysis étincelant* of the French), which is produced in the following way.

An opaque lens sometimes undergoes extensive fatty change, the fatty matter crystallizing as minute plates of cholesterine. If such a lens be broken up, by the ordinary needle-operation, or ruptured and thrown down into the vitreous chamber by a blow, the area of the pupil, on close examination, may be seen full of little shining spots, which glitter like minute particles of gold-leaf. If the eye is kept at rest, they appear inclined to gravitate towards the bottom of the chamber; but the slightest movement sets them again in motion. They are plates of cholesterine, glancing in the light, as they turn in the mingled aqueous and vitreous humors.

It is often very difficult to determine with the ophthalmoscope the precise nature of morbid products in the vitreous humor; for not only is it difficult to bring into a proper focus the variously-shaped bodies, which appear as flakes, rounded granules, filaments, &c., but this difficulty is greatly increased by the rapidity with which some of these bodies are whisked about by every slight movement of the patient's eye. They are, for the most part, coagula of effused blood; mixed, in some cases, with granules of pigment, or the products of inflammation. Some of the larger, more membranous flakes, suggest the notion of their being portions of broken-up hyaloid tissue. We must bear in mind that bodies in the vitreous humor will appear black when viewed with the ophthalmoscope, although they would not do so if seen out of the eye. They intercept the rays of light passing from the patient's retina to that of the observer, and thus produce the effect of dark bodies on a light ground.

MUSCÆ VOLITANTES.

Perhaps there is no affection of the eye which gives rise to greater disquietude, than do these so-called *muscæ* to those who suffer from them. Patients often bear with them for years before seek-ing the surgeon's advice; and very commonly refer, in the meantime, to some encyclopædia or medical treatise for an explanation of their annoyance. In such works they probably find fresh sources of alarm; for "muscæ," in most of the more popular works of the kind, are vaguely enumerated among the earlier symptoms both of "Cataract" and "Amaurosis." It is highly important, therefore, that the surgeon should be able to discriminate between those *floating* spots, which, although in themselves irremovable, are quite compatible with excellent sight, and those *fixed* spots, or disks, which are the effect of isolated portions of retina being insensible to light—a condition not only the source of present impairment of sight, but probably indicating the commencement of some more extended and serious affection.

The term "muscæ" seems very ill-chosen, for I have never heard patients themselves compare the translucent filaments and globules, which sail several years the spots have appeared to increase steadily in number, their apparent multiplication being due to the patient's acquiring, by practice, a greater power of observing those which move on different planes. If the eye be directed towards a clear sky, or a bright cloud, and then kept steadily fixed, the spots will appear to sink slowly downwards, just as ropy particles would do in a liquid which had been shaken and then allowed to rest. A brisk movement of the eye instantly whisks the little bodies about in various directions, and then, as soon as the eye is steadied, they again slowly sail across the field of vision.

When the attention is closely fixed upon any object, the muscæ are not seen—the eye, as it were, ignores them; but if, while regarding some object, the patient chances to catch sight of some of the *muscæ*, he involuntarily begins to notice them, and in a moment his whole field of vision becomes more or less troubled with the floating particles.

If the patient places his head so that he looks vertically downwards upon a well-lighted white surface (as the field of a microscope, for instance), the bodies may, with a little management, be kept so steady as to allow of their being thoroughly examined. They consist, for the most part, of beaded filaments, some nearly straight, others twisted and bent, or massed together into loose knots. The elements of which they are composed are globules, varying much as to the size and regularity of form, and highly refractive.

The filaments are sometimes seen slowly to bend and straighten themselves, and a whole group of them, sufficiently aggregated together to appear of a grayish or light drab color, may be frequently seen to turn so as to present itself in a foreshortened position. This proves that the bodies move freely in a fluid medium, and are not situated (as some have supposed) upon the front surface of the cornea. That such is not their seat, is additionally proved by the fact that they are not in the least affected by the movements of the lids.

If, while the eye is kept fixed, and the bodies are being carefully watched, the lids are briskly moved, no effect whatever is produced in the form or motion of the bodies. They are also distinctly visible, in a strong light, *through* the closed lids, and are then just as free in their movements as when the lids are separated.

After some practice, a careful observer learns to recognize some peculiarly shaped group of convoluted filaments, which seems never to stray beyond certain bounds in his field of vision. In fact, the filaments do not range freely from one side of the vitreous chamber to the other, but are limited to a bag of the humor formed by the septa which partition it off into various subdivisions.*

The most conclusive investigations into the nature of *muscæ volitantes*, are those of JAGO, who, from careful experiments on his own eyes, has satisfied himself that these disquieting spectres are, in fact, nothing more than the beaded filaments of the vitreous body itself. The normal network of these filaments can, he says, be seen by any one who knows how to look for them. I presume under certain conditions of impressibility of retina. Those filaments which, from their being tangled together into confused irregular masses, form such annoyances to patients, would appear to be the normal filamentous network in a disintegrated state.*

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* Jago; Entoptics, with its uses in Physiology and Medicine, 1864, p. 93.

If the foregoing account of the course of *muscæ volitantes* be correct, the reader will at once comprehend how useless,—and worse than useless,—must be the attempt to get rid of them by the various modes of treatment advocated in some of the older treatises on Ophthalmic Surgery. I have met with patients who for the cure of muscæ, had gone through every form of treatment—local and general bleeding, mercury to salivation, tonics, iodine—together with all kinds of drops and lotions, without the slightest benefit. The best comfort the surgeon can give to a patient distressed with *muscæ volitantes*, is the assurance that they are not symptoms of any serious disease of the eyes, that they are irremovable, but quite compatible with excellent and lasting sight. I have had patients under observation for twenty years who, during that period, have been troubled with muscæ in the highest degree, and whose sight is now as acute and good as it was when they first began to notice the spots.

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* Jago; op. cit. Also, Points in the Physiology and Diseases of the Eye; London Medical Gazette, May, 1845. See also Mackenzie; Edinb. Med. and Surg. Journal, July, 1845; and his Practical Treatise, &c., 1854, p. 951.

In the foregoing chapter I observed how impossible it was to treat separately the morbid changes in the retina and choroid. In the same way the vitreous humor, in most of its morbid states, is implicated with those of the vascular and nervous tissues which inclose it. In secondary syphilis the vitreous humor may be full of floating flakes and threads, and yet these bodies do not originate there, but are thrown off from an inflamed and infiltrated retina. So one cannot speak of the *cysticerci*, which are sometimes found in this humor, without mentioning other tissues; for the creatures are developed between the choroid and retina, and it is only after they have perforated the latter that they are found freely moving about in a fluid medium.

CHAPTER X.

THE LENS AND ITS CAPSULE.

PERFECT transparency is the most marked characteristic of these structures in a state of health. During the earlier periods of life, they are also quite colorless; but in most persons who have passed their thirtieth year, the lens begins to acquire a pale yellow tint, and this continues to deepen as age advances, until the part may eventually assume quite an amber color. This fact must be borne in mind when morbid states of the lens come under our consideration.

The fundus of a healthy adult eye is, as we know from ophthalmoscopic observation, a highly reflective surface; and the rays of ordinary daylight, passing from it through the yellowish lens to the eye of an observer, produce the effect of a grayish or drab-colored spot. This reflection it is which the inexperienced, or those upon whom experience is thrown away, so often mistake for opacity of the lens itself. Dilatation of the pupil with atropine, by admitting a greater flood of light to the retina, renders the spot still more distinctly visible; and a patient, who may perhaps really require nothing more than a pair of spectacles, is told that he is the subject of "Incipient Cataract."

The student cannot be too soon made aware of the fact—that pure and absolute blackness is not, under any condition, the characteristic of the pupil in elderly persons: a knowledge of this will save him from falling into constant errors of diagnosis.

We occasionally meet with cases in which there is every reason to suspect that the lens may either have been detached from its natural situation, in consequence of disease, and have fallen out of sight into the depths of the vitreous chamber, or been violently torn from its connections, and wholly ejected from the eye. Upon the presence or absence of the lens, our whole treatment of such cases must depend. How, then, can we with absolute certainty pronounce an opinion on the question?

If, after dilating with atropine the pupil of the suspected eye, we place the patient in the dark, and then slowly move a lighted taper to and fro, on a level with, and at a few inches' distance from, the pupil, we shall of course perceive an image of the flame upon the anterior surface of the cornea. If the lens be wanting, this will be the only reflection visible. If, however, the lens be still in its natural position, two other images, much smaller than that on the cornea, will appear within the pupil: one inverted, which is reflected from the posterior surface of the lens; the other upright, reflected from its anterior surface. If the taper be moved from side to side, the inverted image, which is always indistinct, and sometimes very difficult to be recognized at all, quits its position between the two upright images, and moves away in a direction opposite to that given to the taper.*

Before the invention of the ophthalmoscope, this experiment—which is so valuable, when employed with the object I have just mentioned—was much recommended as a "catoptric test" for deciding the presence or absence of Incipient Cataract. I believe it to be of no real value for such a purpose. Any opacity in the lens sufficient to interfere with the reflection of light from its two surfaces, must be readily appreciable, on simple inspection, by an observer endowed with those powers of adjustment of vision, for near and minute objects, without which no one can profitably study the diseases of the eye.

Altered position of the Lens.—The "suspensory ligament of the lens" being attached to the capsule along the whole extent of its circumference, movements of the lens backwards and forwards must, in the healthy state, be limited to the very slightest amount. A blow, or other shock to the eyeball, however, may rupture some portion of the ligament, and the lens may then acquire mobility proportioned to the extent of the rupture.†

Sometimes the ligament is detached, except at one small spot, and the portion which remains unbroken then acts like a hinge, upon which the lens sways to and fro as the patient's head is inclined forwards or backwards. The iris, in such a case, is tremulous, and vision of course much confused.

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* It is by closely watching these images during the act of accommodation by the observed eye, that experimenters have satisfied themselves as to the change of form in the lens itself being the agent whereby accommodation to near objects is effected. (See p. 3, *ante.*)

† The existence of a suspensory ligament of the lens has lately been altogether denied.

I have spoken of this partial separation of the lens from its suspensory ligament, as being usually the result of external violence; but it must occasionally happen from some internal cause, inasmuch as I have seen it exist in *both* eyes, in a precisely symmetrical degree.

If the transparent lens, inclosed in its still unbroken capsule, be wholly detached from its connections, and dislocated into the anterior chamber, the recession of the iris, and the peculiar reflection of light by the lens,—especially the brilliant luminous ring formed by its margin,—will enable even the most inexperienced to recognize the nature of the accident. In young subjects, a lens so displaced will retain its transparency for several weeks, provided no inflammation occur in the iris to cause effusion of fibrine, and consequent deposit on the capsule. Eventually, however, irritation is set up, and the removal of the displaced body becomes necessary.

DISEASES OF THE LENS.

Every morbid process which takes place in the lens is attended with more or less opacity. The term *Cataract*,* in its modern acceptation, includes under one common head all the varied forms which this opacity may assume. Its meaning should be restricted to the expression of these forms; and it seems very desirable to abolish the term "Spurious Cataract," applied to inflammatory deposits obstructing the pupil. Our nomenclature cannot be made too precise and definite, especially in ophthalmic medicine, overloaded, as it still is, with words outliving the theories which gave them birth.

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* To understand how this word came into use, we must be aware of the opinions held by the ancients as to the nature of Cataract. They

I take it for granted that my readers are already acquainted with the more minute anatomy of the eye, and I will therefore only briefly allude to the healthy structure of the lens, before proceeding to the consideration of its diseases.

Immediately within the very delicate, but firm and transparent, capsule, which incloses it, the lens presents (1) a layer of nucleated cells; (2)

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supposed that a considerable empty space existed between the iris and lens, and that a certain humor, dropping from above into this space, coagulated there into a firm membrane in front of the lens. The latter body they supposed to be quite unaffected by the disease, and this opinion was so firmly rooted in their minds that, even after using a needle to depress a Cataract, they believed they had only removed an opaque skin out of the axis of vision, and had left the lens untouched, and in all its natural transparency. One sees, therefore, how readily they could trace an analogy between a membranous screen descending in front of the lens, and a *portcullis* let down before the gate of a fortress. Now, the original meaning of "Cataracta" is *portcullis;* and in that sense the word is used by Livy (Historiarum, lib. xxviii, cap. 28), where he describes the attempt of Hannibal to take Salapia. The inhabitants raised the portcullis (cataracta), allowed six hundred of the enemy to enter the city, and then: "quum sexcenti ferme intrassent, remisso fune, quo suspensa erat, *Cataracta* magno sonitu cecidit."

within these again are the superficial, softer fibres; and (3) most internally of all, the denser fibres, constituting what is termed its *nucleus*.

Now, when any of these tissues undergo the cataractous change, their peculiar anatomical arrangement is made visible, and we are thus enabled to distinguish the particular portion of lens in which the opacity is situated.

1. Opacities in the superficial cellular layer of the lens—depending, as they do, upon the breaking up and disintegration of the cells, and deposit of earthy or fatty matter—have a milky appearance, extending pretty equally over the whole area of the pupil, and mottled over with opaque white patches, arranged in every variety of figure.

2. The fibres may be said (without entering more minutely into their disposition) to form radii, converging from the circumference to the centre, being more or less curved accordingly as they are nearer to the anterior and posterior surfaces, or to the vertical plane of the lens. So long, therefore, as these fibres, although opaque, retain their integrity, they will be recognizable as *streaks*, having different degrees of curvature, and proceeding in a radiating manner from the edge towards the centre of the pupil.

In process of time, the softer and more superficial fibres, which, during several years, may have been clearly traceable as radiating lines of opacity, lose their linear distinctness, and become blended together into one uniformly whitish or creamy pulp.

3. The *nucleus* is composed of fibres, radiating in the same manner as those of the superficial portion, but of a denser and firmer character than the latter. When this "nucleus" becomes cataractous in an old person, the change seems to consist in a process of drying and atrophy of its fibres, although its amber tint, and a certain degree of translucency, are still retained. When, therefore, softening of the superficial fibres begins, the *nucleus* is the part least disposed to yield; and it sometimes happens that the cortical portion has even passed into a state of fluidity, while the nucleus still remains firm and solid. It was to a Cataract in this condition that the ill-chosen term "Morgagnian" was formerly applied.

In younger subjects, the nucleus of the lens will not have undergone that preliminary process of drying and atrophy which in old persons constitutes its cataractous change; and, therefore, when the softening process sets in, the whole lens may yield, and eventually become completely fluid throughout.

With respect to *Opacities of the Capsule*—formerly supposed to play so important a part in Cataract—it seems doubtful whether they have any real existence in that disease.

STELLWAG,* who has taken advantage of the immense number of *post-mortem* examinations occurring in the General Hospital of Vienna to investigate the histology of Cataract, after a careful microscopical examination of about fifty Cataracts with apparently opaque capsules, asserts that, in every instance, the opacity was produced by matter *attached to the lenticular surface* of the capsules; not *deposited in the very tissue of the capsules themselves.* This matter, which to the naked eye appears identified with the membrane, consists, for the most part, of earthy and fatty substances, firmly adherent, yet separable by careful mechanical or chemical manipulation. The various irregular patches in which the substances arrange themselves, give rise to that marbled or mottled appearance hitherto described as characterizing the *mixed*, or "capsulo-lenticular" form of Cataract.

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* Die Ophthalmologie, &c., 2 vols., 1853–8.

A distinction between opacities *upon*, and opacities *of*, the capsule, has comparatively little interest in a surgical point of view; although it is very important in its bearing on classification and nomenclature. But my present object is not to discuss questions of nosological arrangement, but merely to point out the various aspects which marked opacity, quite independent of any earthy or fatty matter which may still be adhering to their surface, or of any inflammatory deposit exuding upon them from the vessels of the iris.

If the arrangement of Cataracts under the two heads, "Lenticular" and "Capsular," be abandoned, as founded on an anatomical error, their classification as "Hard" and "Soft" is by no means unobjectionable. Neither of the latter terms expresses more than a certain stage in the progress of Cataract. For in the so-called "Hard Cataract" of an old person, it is only the *nucleus* that undergoes any condensation or drying of its tissue; the peripheral portion is no harder than that of a healthy lens; and as soon as the softening sets in, the whole of this portion actually undergoes a change from solid to fluid.

The terms "Nuclear" and "Cortical" may be conveniently used to distinguish the two grand divisions of Cataract.

The *nuclear* form is that met with in old persons, either alone or (much more frequently) in combination with *cortical* opacity.

Under the head of *Cortical* Cataract would be arranged—1. That congenital kind characterized by a single white dot (Cataracta centralis) or cone (Cataracta pyramidata) corresponding to the middle of the pupillary space.

2. That rarer form, occurring both in childhood and at adult age, which exhibits itself in irregular, opaque patches on the anterior or posterior surface of the lens, and immediately within

the cavity of the capsule. These have hitherto been described as opacities of the anterior or posterior capsule itself.

3. That which is the most common Cataract of middle age, and even of old age, commencing as opaque striæ at the edge of the lens, and thence converging along its anterior and posterior faces.

The softening process which, sooner or later, involves *all* Cataracts, is invaribly *cortical* in its origin; the nucleus being, as I have said, always the last portion to undergo solution.

Having drawn this slight sketch of the nature of Cataract, and its mode of development, I may now proceed to notice the leading varieties of appearance it presents, as modified by the duration of the disease, and age of the patient.

To give special names to Cataracts, according to the various figures which the opaque deposits may assume, is but to confuse the student's mind, and burden his memory with a mass of unnecessary terms. It must be evident that the transparent and opaque elements of a Cataract may so arrange themselves as to induce an endless variety of shades and markings, which practice alone can render familiar and intelligible. All that a teacher can do, either orally, or in a volume like the present, is to describe the general laws which govern the formation of Cataract, and then leave the student, by patient observation, to acquire tact in the diagnosis of particular cases.

The two important marks for him to keep in mind, as indicating the composition of a Cataract, are—(1) striated, radiating opacity; and (2) irregular, patchy, or mottled opacity. The former always shows that the fibres of the lens still retain, to a certain extent, their natural arrangement, however they may be here and there broken down, or otherwise changed, and mixed with granular, earthy, or fatty matter. The latter appearance is a proof that the superficial fibres have been softened down into a pulp, and mixed up with the substances I have just enumerated.

Congenital Cataract appears under four well-marked forms:

1. As a minute dot, of a chalky whiteness, occupying the middle of a clear and dark pupil, and seeming to be situated in the thickness of the anterior capsule. In reality, however, it is a little mass of earthy and fatty matter, deposited in the most superficial portion of the lens itself, immediately within the capsular cavity. These central dots (*Cat. centralis*) are frequently overlooked at birth, and sometimes even remain unnoticed by the patient in after-life. They are not necessarily attended with any extension of opacity to the rest of the lens, and are compatible with very useful sight.

2. A more extensive deposit of the same nature is that described by authors as "*Cat. pyramidata.*" It resembles the foregoing variety as to its central position, but is so much larger that it occupies nearly the whole area of the contracted pupil. The deposit is like a little obtuse cone of chalk, the base of which seems to adhere to the

anterior capsule, and its apex to project forwards through the pupil. This, however, is not really the case; the opaque mass is imbedded in the superficial anterior portion of the transparent lens, and the capsule is continued uninterruptedly over its apex.

It sometimes happens, both in central and pyramidal Congenital Cataract, that the rest of the lens, instead of retaining its transparency, is slightly opaque. In that case vision would, of course, be very much restricted, and an operation for the removal of Cataract would be indicated. When lenses of the latter kind are broken up, the little cones usually fall off at the first touch of the needle.

3. The most frequent form of Congenital Cataract is that in which the whole area of the pupil, in its natural state, is occupied by a grayish-white, faintly striated opacity, the striæ converging from the margin of the pupil, to terminate, at its centre, in a dot more white and opaque than the rest of the lens. If the pupil be fully dilated with atropine, the outer part of the space appears perfectly black, or else a few white streaks are seen passing, here and there, across this black area, from the margin of the lenticular opacity, to lose themselves behind the iris. The inexperienced observer would be led to believe that the whole of the lens was opaque, and that its bulk was altogether much less than that of a healthy subject. But, in reality, the clear, black, ring-like portion of the pupil surrounding the opacity is occupied

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is not to be removed from the
by any person or

by the peripheral portion of the lens, which is in a transparent condition, save for the isolated opaque radii which traverse it in the manner I have just noticed.

This peripheral transparency frequently continues during adult life; so that a person whose sight is limited to the perception of large objects, so long as his pupils remain in their natural condition, may, by the use of atropine, expose such a ring of clear lens as will enable him not only to read, but even to follow employments requiring a very close appreciation of minute objects.*

4. By far the rarest form of Congenital Cataract is that in which a limited deposit occurs among the cortical fibres of the lens, either on its anterior or posterior surface. Such irregularly-shaped patches appear to be of the same earthy and fatty nature as those which have been frequently noticed in adults, and described as opacities of the capsule itself.

A case of this kind, which came under my notice some years ago, was at that time the only instance in which I had observed Congenital Cataract to be limited to one eye. The opacity was chiefly formed by a patch quite at the back part of the lens; and it therefore appeared to be very deeply seated. It had, also, the faintest possible tinge of yellow or buff. Careful examination, with a fully dilated pupil, convinced me that the dense opacity was really in the lens, throughout which there also extended a very slight, barely perceptible haziness. I accordingly operated, by *Keratonyxis*, when the child was six months old; and the case did perfectly well. By a curious coincidence it happened that, while the child was under my care, a case of Congenital Cataract in one eye only occurred in the practice of one of my colleagues, who had not previously met with an instance of the kind.

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* I had under my notice for many years a case which strikingly illustrates these remarks. A man about forty years of age had Cataract in both eyes from birth. The left lens was not only very opaque at its centre, but the peripheral portion was also slightly cloudy. With this eye he could discern large objects, but could not distinguish type. In the right eye, the area of the pupil, while in its natural state, was also wholly occupied by a pretty dense opacity; but when he used atropine, a perfectly clear portion of lens was brought into view, and he not only was able to read, but to do the fine work of a watch-finisher, adjusting even the delicate works of Geneva watches. He had used belladonna or atropine during the greater part of his life, without any impairment of the natural motory power of the iris having resulted,

If infants who have Congenital Cataract are also the subjects of *hereditary syphilis*, they may be attacked with Iritis within a few weeks of their birth, and adhesions may form between the pupillary margin and the lens, which will prevent the usual effects of atropine being manifested. At the same time the anterior surface of the capsule may become thickened by inflammatory deposit, which will prevent any view of the fibrous structure of the lens.

Congenital Cataract is usually, although not always, attended by an incessant twitching movement of the eyeball, termed "Nystagmus." This, however, is not peculiar to cases of Cataract, but may occur where there has been ulceration, and consequent opacity of the cornea, soon after birth.

Morbid appearances which may be mistaken for Congenital Cataract, are afforded by Scrofulous or Encephaloid deposit in the fundus of the eye. These deposits, if seen at an early period, may be distinguished by their *deep* situation, and their more or less *yellow color*. Nothing but practice will give the student the power of appreciating at a glance the relative distances of opaque objects seated in the transparent media of a patient's eye. To the beginner, a nebula on the cornea, a patch of opacity on the anterior or posterior surface of the lens, and a deposit on the retina, appear almost on the same plane. The yellow color, also, of scrofulous or malignant deposit is sometimes very faintly marked at first: at a later stage it assumes a golden hue, and in the case of encephaloid disease, vessels may be seen ramifying in the mass. The ophthalmoscope would now be called in to aid diagnosis.

If, however, a case of the latter kind is not seen until the lens has become cloudy, it may require a careful examination to decide whether the affection be one of Simple Cataract, or of Cataract consequent upon a malignant deposit in the vitreous chamber. In the later stage of malignant disease, the pupil becomes widely dilated, and fixed; which is never the case in Simple Cataract.

Obliteration of the anterior chamber, by bulging forward of the iris; immobility of the pupil; a generally diffused cloudiness of the lens; and a yellowish tint, which seems to be imparted by something advancing from behind, are circumstances which should make the observer suspect something more than a mere affection of the lens.

As a rule, too, Congenital Cataract affects both eyes; Encephaloid disease only one. Scrofulous deposit, although it may eventually destroy both eyes, seldom attacks them to the same extent, or at the same time.

Cataract in Children.—Except as a result of injury, Cataract is rarely seen to *commence* during childhood; I mean between infancy and puberty. If opacity diffused throughout the entire lens be met with at that period of life, it is commonly the result of a further cataractous change in an eye affected from birth with the ordinary congenital disease—a condition which had been overlooked so long as the opacity remained in its original state of development.

And that it may be so overlooked is not at all improbable; for the congenital opacity (confined to the central portion of the lens, and leaving the periphery transparent, in the manner already described at page 228) is sometimes so faintly marked as to be wholly unobserved by the child's friends. When, however, a fresh extension of opacity takes place, and spreads quite up to the extreme edge of the lens, superficial softening and disintegration slowly set in; and the milky, chalky, or mottled aspect, which the pupil then assumes, is sure to attract attention. It far more frequently happens that no such extension of opacity or softening occurs, but that the Congenital Cataract remains up to adult age in its original state (page 229).

I have, however, met with a few cases in which it appeared to me that Cataract, of a peculiar kind, first began to be developed when the patients were about the age of nine or ten years. The children had gone to school at, perhaps, the age of seven or eight, and at first had seen quite well, so as quickly to learn to read. At the end of a year or so their sight began to fail; they could not read, except at a short distance, and even then imperfectly, and could hardly recognize faces across a room. They were supposed to be "growing short-sighted"—if, indeed, their deficiencies received so merciful an interpretation, and did not bring down punishment for their supposed inattention and idleness.

I have notes of several such cases, and on referring to them I find three distinct forms of opacity described. In every instance, the utmost care and pains were required in the examination; a well-dilated pupil, and light concentrated by means of a magnifying glass being indispensable.

First form.—An irregularly-shaped patch on the posterior surface of the lens, looking as if it were seated in the capsule itself. This patch has, in most instances, been placed—not in the axis of vision, but at the edge of the lens, extending, however, towards the centre. In one patient, who had a posterior patch of this kind in each lens, I watched the opacity from month to month during a year, without observing any change to take place in it. I then lost sight of the case for a few months, after which time the child was brought with the left lens wholly opaque, and of a bluish-white, "skim-milk" appearance; the other lens remaining as before.

Second form.—The lens dotted throughout with fine white points, disposed in the course of the fibres; the intervening portions of lens being transparent. These points were as minute as if pricked with the finest needle, and the general effect produced was that of a very faint haziness of the pupil. The patients were ten or eleven years old; and they described their dimness and extreme shortness of sight as having been first noticed about a year before they were brought to me.

In breaking up these lenses, by the operation of *Keratonyxis*, I was struck with their unusual softness; even their central portion seemed as unresisting as the periphery; and the needle passed through their substance as if it had been so much jelly.*

The *third form* I have seen in only one patient, a sturdy little country boy, eleven years old. The irides were very active, and the pupils, in their natural state, offered no peculiarity of appearance. With the right eye he could barely discern a difference of shade between a printed and a blank page: with the left he could read large type. On dilating the pupils, and concentrating light on them with a magnifying glass of one inch focus, I perceived the whole posterior face of the right lens to be covered with very fine opaque lines, closely set together, radiating from the circumference towards the centre, so as to produce the effect of a concave surface, composed of a delicate fibrous membrane. At the centre of this surface, in the axis of vision, was an opacity in the form of a ring, more dense than the rest; the area, however, not being black and clear, but hazy, like the remaining portion of the hinder surface of the lens. The left eye presented somewhat the same appearances, but in a slighter degree; the posterior striæ being wider apart, and the ring-shaped opacity in the axis of vision only indistinctly marked.* The whole of the lens, with the exception of this posterior opacity, was perfectly transparent.

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* See a report of one of these cases in the Medical Times and Gazette, for June 18th, 1853, p. 631.

I may seem to be needlessly minute in describing the appearance of these peculiar forms of Cataract—and mere verbal descriptions are unavoidably somewhat dry and tedious,—but the affection is so liable to be overlooked, and the patient's prospects in life may be thereby so materially thwarted, that I have thought it right to enter into such details as may enable the student to detect these rare and most delicate forms of lenticular change.

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* This ring-shaped opacity, in different varieties of form and size, I have seen in middle-aged and old persons. It no doubt consists of earthy and fatty deposit, such as is commonly found in cortical opacity of the lens; but I cannot say on what its peculiar ring-like form depends.

Cataract in adults and old persons.—From puberty to the age of forty, opacity of the lens is rare, except as a result of injury. When it does occur spontaneously, it is *cortical* in its origin; the margin of the lens first exhibiting opaque striæ, which gradually converge as they extend themselves along its anterior and posterior faces. Between forty and fifty, Cataract may still be said to be rather a rare disease; but from fifty to sixty, and so on, up to the later years of life, it is the defect we naturally expect to find when a patient consults us for failing sight.

It is impossible to fix the exact time of life at which that peculiar morbid change takes place in the nucleus, described at p. 223. Perhaps sixty might be named as the age after which it may be expected to occur; although I am perfectly convinced, from repeated and careful examination of patients, that even to extreme old age it is much more common to find marginal opacity beginning while the nucleus is still clear, than to find nuclear opacity beginning while the periphery of the lens remains transparent.

Whether cataractous opacity usually spreads from the centre of the lens towards the circumference, or from the circumference towards the centre, is—as the reader must readily perceive—no question of mere pathological nicety. It has a most important bearing on diagnosis and treatment.

An elderly patient presents himself, complaining of some slight mistiness and indistinctness of sight. The iris may be active; the area of the pupil of natural blackness: Cataract will not suggest itself to the surgeon, if he be prejudiced by believing that it almost always commences in the centre of the lens; and he will probably regard the dimness of sight as altogether of nervous origin. But let him fully dilate the pupil with atropine, and then throw light upon each part of the lens in succession, by means of a convex glass of about one inch focus; he will perhaps find the whole posterior face of the lens covered with faintly yellow, opaque lines, radiating inwards from the margin, and, along the latter part, grouped together here and there into patches; or these marginal patches may exist at one or two points only, the hinder face of the lens being to a considerable extent clear. This would denote a still earlier stage of the disease. Or again; in addition to opaque patches at the edge of the lens, a few striæ may be traced along the front surface, stopping short of the border of the natural pupil. The anterior position of these striæ can of course be at once recognized by a practised observer; but it may aid the less experienced to be told that the opaque streaks of a cataractous lens are in themselves white. Those on the anterior surface, therefore, being viewed through colorless media —the cornea and aqueous humor—retain their white appearance; while those behind acquire a yellow cast, from being seen through the still transparent part of the lens.*

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* See Ruete, Bildliche Darstellungen, &c., pl. xxxi, fig. 3.

In some works, minute directions are given for investigating the *subjective* symptoms of Cataract; that is to say, inquiring as to the various changes of sight which the patients themselves are conscious of. The surgeon need not lose his time in such inquiries. The only way to find out whether a patient has commenced Cataract is—*to look for it.* A well-dilated pupil; a clear, concentrated light; a knowledge of what he is to search for, and how he is to find it—comprise all the conditions requisite for enabling the surgeon to detect opacity of the lens.

The aid of the ophthalmoscope will naturally be sought in clearing up difficult diagnosis of Cataract. Practically we find that an intense light renders *very faint* striæ invisible, and a moderate amount only of illumination should be employed. Dense opacities appear under the ophthalmoscope as perfectly black lines.

The following is the ordinary progress of Cataract in elderly persons. At first, opaque streaks appear at the extreme edge of the lens; most commonly I have observed the lower edge to be first affected. The streaks gradually coalesce into patches, and spread themselves over the posterior face, a few only extending a short distance along the anterior face. The Cataract may perhaps remain in this state for a year, or more; then the whole body of the lens becomes slightly hazy, but not so much so as to prevent the posterior radiated opacity from being recognized. Gradually the opaque streaks advance farther and farther along the anterior face of the lens, until they appear within the area of the undilated pupil. By this time the general haziness has increased so much that the posterior face of the lens is hidden from view, even when concentrated light is thrown into the eye; and the opacity, both the linear and the diffused, becomes denser and denser, until little more than the anterior surface of the lens can be seen. Cataract is then complete, and vision commonly restricted to mere perception of light.

As years go on, the surface of the lens usually becomes more and more opaque and white, in consequence of the increased deposit of earthy and fatty matter. The latter sometimes assumes the form of cholesterine, in such large crystals as to give the surface of the Cataract a sparkling appearance, as if powdered with minute particles of gold-leaf. Should a lens in this state become ruptured and dislocated, and sink out of view into the vitreous chamber, crystals of cholesterine are set free, and, by dancing up and down within the pupil, produce the phenomena of "Sparkling Synchysis" (p. 210).

If, as sometimes happens, the superficial softening and deposit of white matter be retarded, the Cataract has a dull, brownish aspect, like clouded horn, and in this state is often extremely difficult to detect.

Occasionally the lens is found of so deep a brown that it is called a "Black Cataract." In very rare instances, however, absolute blackness is met with.*

Fluid Cataract.—In lenses which have become opaque, either from disease or injury, the softening process will sometimes slowly go on until nearly the whole mass has passed into the fluid state. It was to the early stage of this process that the term "Morgagnian Cataract" was formerly applied, in the belief that it was the "humor"—falsely supposed by MORGAGNI to exist, in the healthy state, between the capsule and lens—which became opaque, and formed the impediment to vision.†

The most uniform characteristic of Fluid Cataract is a total absence of those radiating streaks so evident in ordinary Cataract, where the fibres of the lens, although deprived of their transparency, still retain their natural arrangement.

Fluid Cataract is frequently white, with a faint bluish cast, like milk and water; this tint being either uniform throughout, or irregularly mottled here and there with more opaque patches. In other cases the lens assumes a dirty-gray color, aptly compared by LAURENCE to that of "thick gruel."

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* In my first edition I asserted the contrary, but within a few weeks after the publication of the volume, a Cataract was removed by one of my colleagues, which, when extracted, appeared entirely black. Before the operation, there had been no suspicion of its peculiar nature. It had seemed to be of a deep color within; but several fine whitish lines radiated on its anterior surface, formed, no doubt, by slight earthy deposits just inside the capsule.

† It is curious that Morgagni himself attributed Cataract to a morbid process the very reverse of this! So that his name has been made use of, as it were, to oppose his own opinion. His own words are,—"Tunica [crystalloide] in vitulis etiam, bobusque, sive recens sive non ita recens occisis perforata, pluries animadverti illico humorem quendam aqueum prodire: quod et in homine observare visus sum, atque adeo credidi *hujus humoris secretione prohibita*, crystallinum siccum et opacum fieri fere ut in extracto exsiccatoque crystallino contingit." (Adversaria Anatomica, &c., Lugd. Bat. 1741, Adv. vi, p. 90.)

Sometimes a faint tinge of yellow, and a seeming inequality of consistence, give to a perfectly Fluid Cataract the appearance of curdled cream. In such a case the most practised eye may fail to distinguish the morbid change from one of a directly opposite character—namely, that in which the solidity of the lens has been increased by earthy deposit. The creamy color is usually a sign of the Cataract having existed in the liquid state for a considerable time.

Fluid Cataracts are commonly said to be larger than solid ones, and to manifest their greater bulk by pressing the iris forwards, and lessening the capacity of the anterior chamber. The latter part of this statement is by no means uniformly true; for cases of genuine Fluid Cataract occur in which the iris deviates little, if at all, from a vertical plane; and a fluid lens, even if actually increased in size, may, on account of some alteration in the vitreous body, project backwards, instead of pressing forwards into the pupil.

It is asserted that the opacity of a Fluid Cataract is most marked towards the lower part, in consequence of the gravitation of its denser particles, and that a brisk movement of the eye, by mixing together the contents of the capsule, will at once cause the opacity to become uniformly diffused. This effect of gravitation is, I apprehend, but rarely seen, except by a very practised observer, and cannot be much relied upon as a means of diagnosis.

A Cataract in a perfectly fluid state may intercept the rays of light more completely than one which is solid; sometimes to such a degree as almost to destroy the power of perceiving light. One must be careful, therefore, in describing a lenticular opacity as "dense," to distinguish between the two senses in which this word may be used; since an opacity may have great density in the sense of being *impenetrable to light*, while yet of the least possible density in the sense of *firmness of texture.**

Traumatic Cataract.—Wounds of the lens not only render the injured portion opaque, but the opacity gradually extends throughout the lens, producing an appearance closely resembling that of a spontaneous Cataract.

lens imbibe the aqueous humor; they become dissolved, and eventually absorbed. It is on this physiological fact that the beautiful operation for removing Cataract *by solution* is founded.

If the capsule and lens have been freely punctured with a thorn, or any sharp instrument of considerable size, the greater part of the lens is gradually absorbed, while a certain portion remains, and undergoes fatty and earthy change. The Cataract thus formed acquires, after some years, a flattened, disk-like figure, and stands much farther back from the plane of the iris than a full-sized opaque lens. It has also an unequally mottled, dead-white appearance, and sometimes exhibits crystals of cholesterine.

Capsule never becomes absorbed.—When lacerated in various directions, its shreds contract, roll up, and shrink together to a remarkable degree. However wasted, therefore, a lens may become after such an injury as I have just described, its remains are always inclosed in a capsule, which is thickened on its lenticular side with earthy deposit, and on its outer surface with an inflammatory membranous coating, in the event of Iritis having occurred. In the latter case, too, the pupillary margin will have become more or less united to the capsule, so as, perhaps, wholly to resist the action of atropine.

In *old* traumatic cases, it very often happens that the inexperienced observer fancies he discerns a clear black aperture at some part of the opaque capsule, and wonders, therefore, that the patient has not a considerable amount of sight; whereas the *supposed clear space* in the capsule is really nothing more than a *patch of black pigment*, deposited upon it from the hinder surface of the iris. Concentration of light, by means of a convex glass, will greatly assist in detecting the real nature of such patches, which are often extremely deceptive, even to practised observers.

The shreds of capsule, which remain after the lens has become absorbed in consequence of injury, may exhibit such varieties, in respect of form and degree of opacity, that to enter into minute descriptions of them would be uselessly tedious. Practice will alone enable the student to distinguish between a streak of white opacity on the surface of an otherwise transparent lens, and a strip of opaque capsule stretching across the dark area of a pupil from which the lens has been removed.

Where the lens has been wholly absorbed, in consequence of a well-performed needle-operation, or an accidental wound, the lacerated capsule gradually shrinks away from the centre of the pupil towards the suspensory ligament, and eventually forms a white ring, which, in the more contracted state of the pupil, is hidden by the iris. Dilatation of the pupil with atropine is, therefore, very often a means of clearing up an obscure case, by revealing the manner in which a lens has been got rid of.

The posterior capsule, which so frequently forms an impediment to distinct vision after a successful operation of Extraction, often requires for its detection a peculiarly close scrutiny, with the aid of concentrated daylight, and of the ophthalmoscope, so delicate and filmy is its texture, and so slightly does it modify the blackness of the pupil across which it is stretched. And yet, trifling as such a film may appear, it may deprive the patient of much of the benefit of the operation he has undergone, and just make the difference to him of being able or unable to read.

I need hardly say that cases of Traumatic Cataract are sometimes extremely complicated, in consequence of the cornea, sclerotic, or iris, being involved in the injury. The appearance which the corneal wounds present will be found noticed under the head "Cornea" (p. 131). The dilatation which they sometimes require, to allow of the escape of a partially dislocated lens, will be treated of when the operation of Extraction is considered. *Subconjunctival Dislocation of the Lens* has already been separately described.

CHAPTER XI.

GLAUCOMA.

An anatomical arrangement cannot be rigidly maintained throughout a work like the present. Where practicable, such an arrangement is convenient, as enabling the student readily to concentrate his attention upon the most striking appearances presented by isolated portions of a very complicated organ; but under certain morbid conditions several tissues of the eye are affected at the same time, and it then becomes impossible to include them all under a single anatomical term. Thus it is only in a very forced and arbitrary manner that "Iritis" has been confined under the head of "Iris." Glaucoma, however, includes such a variety of morbid changes, that it is utterly impossible to arrange them under any one anatomical division; I have therefore placed "Glaucoma" by itself, as the heading of a separate chapter.

At the present day the term suggests a state of the eye wholly different from that which it suggested a few years ago. The more advanced stage of the disease, and especially the strongly marked and unmistakable outward appearances of complete glaucomatous degeneration, were formerly well recognized; but the earlier symptoms were not understood in their true character. The visible inflammation was regarded as an evidence of gout or rheumatism, while the antecedent failure of sight was classed among the manifestations of "Amaurosis," that shadowy and uncertain limbo for all that was obscure in ophthalmology. Since GRÆFE drew special attention to the subject, the important premonitory symptoms of Glaucoma have been estimated at their true value, and the connection between them and the hopeless condition to which alone the name "Glaucoma" was formerly applied, has been recognized in all its importance. Observers have hitherto been less successful in explaining the true pathology of the disease; and hence it is that the precise *rationale* of Iridectomy, as a curative measure, still remains to be explained. We must be content to employ it without being able to give any clear theoretical reason for our procedure.

The subjects of Glaucoma are usually beyond the middle period of life. Persons under forty may be attacked; but perhaps the most common period is from fifty to sixty, and from sixty to extreme old age the disease is by no means uncommon. Sooner or later both eyes usually become involved.

There are two distinct forms of Glaucoma: in one, the outburst of inflammation is preceded by a long period of premonitory symptoms; in the other, the attack comes on with startling suddenness.

The peculiar *premonitory symptoms* of Glaucoma consist in intermittent attacks of dimness of vision. A patient perhaps sees well up to the middle of the day; then objects appear as if involved in smoke, and reading becomes difficult or impossible. This dimness may last for the rest of the day, and the next morning it may have quite passed off, to retürn again in the course of a few hours. This intermittent dimness may go on for months, with little, if any, external appearance of inflammation; in other cases, the onset of dimness is attended with slight redness and watering of the eyes. In fact, unless the peculiar premonitory symptoms of incipient Glaucoma are well understood, a case of the most serious kind may be lightly regarded as one of unimportant Catarrhal Ophthalmia.

A luminous object, a candle, a lamp, &c., appears surrounded with a halo of prismatic colors. The iris approaches the cornea, and the pupil is inactive, although, perhaps, not dilated; and, unless the attack be very slight, the surface of the

The premonitory obscurations may persist for weeks; with occasional interruptions, even for months; and patients may be liable to intermittent attacks for a year or more, before any outburst of acute inflammation occurs. Neuralgia in the ophthalmic division of the fifth nerve is commonly added to the other premonitory symptoms.

If the eyeball be carefully examined during any period of glaucomatous disease, it will be found in some degree harder than natural. This hardness goes on increasing, until, in the last stage of Glaucoma, the globe feels almost like a ball of stone. I know of no instance in which the *tactus eruditus* of the surgeon is more severely tested than in examining some of these incipient cases of Glaucoma. The same eyeball may suggest to two able examiners different degrees of hardness, or they may even disagree as to whether the eye be abnormally hard at all.

While the patient gently closes the lids, the surgeon is carefully to apply the tips of his fingers upon the upper part of the globe, lightly pressing upon its coats. And again, when the patient opens the lids and looks upwards, the surgeon presses the middle part of the lower tarsus steadily against the sclerotic, just below the cornea, and carefully notes the degree of resistance he meets with. I need hardly say that too great softness of the globe is as much a mark of disease as too great hardness, and that, to discriminate truly between the various degrees of what is too hard and what is too soft, the student must familiarize himself with the exact amount of firmness and elasticity indicative of a sound state of the coats and humors of the globe, by means of that careful fingering which repeated practice alone can give.

Donders and others have devised formulæ for noting down the amount of tension in the globe; but the gradations are so manifold, that it is scarcely possible to tabulate them correctly according to any fixed plan.

Rest of the eyes, careful attention to general health, and iodide of potassium internally, I have found to constitute the best mode of treatment in this stage; but the patient must be warned as to the true significance of the symptoms, and as to the probable onset eventually of acute Glaucoma.

It was to the ophthalmoscopic appearance of the optic nerve and its vessels, in all stages of glaucomatous disease, that Græfe drew such especial attention. In well-marked cases the optic nerve appears concave, and the retinal vessels, instead of passing off from their point of emergence in a straight direction, to ramify on the retina, begin by curving over the edge of the cup-like depression of the end of the nerve. Very slight pressure on the globe with the finger causes visible pulsation in the retinal vessels; or this pulsation may exist without external pressure. In the slowly advancing, early stage of glaucomatous disease, mentioned at the commencement of this chapter, the depression of the optic nerve may be so trifling as to escape observation; but in confirmed cases it is very marked. When the disease has come to a crisis, and acute Glaucoma has set in, the details of the optic nerve and retina cannot be seen with the ophthalmoscope, owing, I believe, in great part to the condition of the corneal surface, which produces irregular refraction of the rays of light. In the advanced stage of Glaucoma a dull red glow is sometimes all that can be seen.

As disease goes on, the dimness of sight, instead of being intermittent, becomes permanent, and the field of vision gradually contracts, so that at last the patient, in viewing objects, seems to be looking at them through a small hole in a screen. Sometimes, however, this narrowing of the field of vision does not take place, the dimness being pretty uniformly diffused. By this time other marked changes have taken place in the globe. It has acquired a peculiar stony hardness; the veins on the sclerotic emerge abruptly near the edge of the cornea, as thick, purple trunks; the pupil gradually dilates until, in old cases, the iris almost disappears; acquiring, at the same time, a peculiar slaty tint. Eventually, the veins of the iris enlarge, and are especially noticeable as a ring-like plexus near the pupillary margin. The lens at last becomes opaque, milky-looking, and indistinctly striated; it is often of a grayish drab, dirty yellow, or dull orange, or marked with earthy streaks and patches. Its threefold division is often very well marked, as if, by undergoing maceration in water, it had swollen up and were about to burst its capsule. By this time even perception of light is usually quite lost.

From what I have already stated, as to the various changes in Glaucoma, it will be understood that it is by a careful comparison and estimate of several morbid appearances taken together, that the disease is to be discriminated, and not by the presence of any one distinctive sign. If mere abnormal hardness of the globe be assumed as the proof of glaucomatous change, several forms of inflammation and degeneration quite distinct from Glaucoma may be mistaken for that disease. A "cupped" condition of the optic nerve may simply be the result of chronic wasting. Colored halos around luminous objects are commonly associated with ordinary Catarrhal Ophthalmia. But let all these symptoms co-exist,—intermittent obscuration of vision, colored halos, fixity of the pupil, increased hardness of the globe, a changed condition of the corneal epithelium, cupping of the or from both causes combined, the optic nerve and retina cannot be discerned, and the ophthalmoscope only reveals a dull red glow from the fundus.

Treatment.—No plan of treatment for Glaucoma, that could be termed curative, was known at the period when GRÆFE announced his operation of "Iridectomy" in the journal of which he is co-editor,* and subsequently more fully developed the subject at the Ophthalmological Congress, which met at Brussels in 1857. He stated that "intra-ocular pressure" was the cause of all the phenomena, and that the removal of a portion of iris, in the way he described, by relieving the pressure, cut short the disease.

At the beginning of the present chapter I have alluded to the obscurity that still hangs over the pathology of Glaucoma. For the present we may be well satisfied with the knowledge that in Iridectomy we have a means of controlling an otherwise incurable disease, and saving patients from the blindness which was formerly its inevitable result.

GRÆFE's operation is performed as follows: the globe having been fixed with a forceps, a lance-knife is passed obliquely through the sclerotic, about a line and a half from the spot where it blends with the cornea, so as to make a wound penetrating into the anterior chamber. An iris-forceps is then passed through the wound, a fold of iris seized, drawn out, and then cut off close to its ciliary attachment. GRÆFE and others lay particular stress upon the iris being removed quite at this point, but I do not believe it to be at all essential. I have always performed the operation with a Beer's knife, making, in fact, a corneal wound just like the upper section for flap-extraction, but on a much smaller scale. This wound is a good deal anterior to that recommended by GRÆFE, and passes through the true cornea, but close to its sclerotic union. The iris, consequently, is not divided quite up to its ciliary attachment; and yet I have found the result of the operation just as satisfactory as that first described. In acute Glaucoma the lens always advances forwards, close up to the cornea, and is therefore endangered by the thrust made with the lance-knife; whereas, in using Beer's knife, in the way I have mentioned, its point is always kept in front of the iris as it lies against the projecting lens. It appears to me that if a peripheral portion of the iris is removed, sufficient to establish a free communication between the anterior and posterior chambers of the aqueous humor, the object of the operation has been attained.*

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* "On Iridectomy in Glaucoma, and on the Glaucomatous Process." Archiv für Ophthalmologie, vol. iii, part 2, p. 456.

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* If this view be correct, the explanation of the beneficial effect of Iridectomy, which has been offered by those who prefer Mr. Hancock's operation, becomes inconclusive. They consider that the unintentional division of the fibres of the ciliary muscle, during the performance of Græfe's operation, and not the removal of the piece of iris, constitutes its real value. But if Iridectomy, performed in the way I have recommended, be found as effectual as when the iris is re-

Mr. Hancock recommends the following operation in Glaucoma, as being greatly preferable to Iridectomy. The point of a cataract-knife is inserted at the lower and outer part of the edge of the cornea, and carried in a direction obliquely downwards, dividing the sclerotic to about the extent of two lines, and penetrating through the corpus ciliare into the vitreous humor. The incision also divides the attachment of the iris, and the delicate fibres constituting the "ciliary muscle." The division of these fibres—which I have already spoken of as chiefly constituting the apparatus for changing the form of the lens in the act of accommodation—Mr. Hancock regards as the essential point of the operation, since he imagines their spasmodic contraction to be the primary cause of the phenomena of Glaucoma.

In performing the operation of Iridectomy, great care must be taken to avoid wounding the lens, which, as I have said, always projects towards the cornea, and is sometimes in actual contact with it. This danger is avoided by making the corneal incision in the way I have recommended.

A good deal of blood usually flows from the cut iris into the anterior chamber, sometimes quite filling it. This blood soon becomes absorbed, if the eye is kept at rest, and bandaged,

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moved quite up to its ciliary attachment, through a wound penetrating obliquely into the anterior chamber, it follows that division of the ciliary muscle can in no way contribute to the beneficial result of the operation.

with a carefully adjusted amount of pressure, for twenty-four hours. When, after this period, the eye is examined, the cornea is found to be clear, and the peculiar unevenness of its epithelial surface has given place to the normal mirror-like smoothness.

The recovery of sight after a well-timed and well-performed Iridectomy is most remarkable; in many cases almost amounting to the restoration of former good vision; but in other instances the patient is greatly annoyed by the dazzling appearance and the distortion of luminous bodies —the result of the over-large pupil, and the consequent flooding of the eye with light. Tinted glasses, an opaque diaphragm perforated by a narrow transverse slit—either with or without a low convex glass—or other optical contrivances, must be resorted to according to the circumstances of the case. But even if, with all these appliances, the patient is still annoyed by irregular refraction, this comparatively trifling inconvenience is not to be put in comparison with the benefits of Iridectomy, without which utter blindness must inevitably have closed the scene.

CHAPTER XII.

SCROFULOUS AND ENCEPHALOID DEPOSITS.

SCROFULOUS deposit within the globe, going on to total destruction and atrophy of the organ, occurs chiefly in infants and young children. It is in similar subjects that Encephalöid deposit is most common, and the two products, so essentially different from each other in their histology and ultimate results, present, at a certain stage, almost similar external appearances.

Both in the Scrofulous and the Encephaloid disease, the first symptom noticed by those who have the care of the child is a yellowish, golden, or buff-colored reflection from the pupil, which in certain lights seems to shine like a cat's eye. Perhaps, also, the affected eye is tested, and found to be blind.

In this early stage it is very difficult for the surgeon to pronounce positively on the nature of the case. He finds a more or less dilated pupil; and, on looking through the still transparent lens towards the opaque and yellowish surface of the retina, he observes this structure to be thrust forward in an irregularly lobulated form, and overspread with enlarged vessels, ramifying in various directions over the uneven surface.

In a more advanced stage of the disease these deep-seated changes are still more readily seen, in consequence of the dilated condition of the pupil; the iris being reduced to a mere ring. The yellow deposit slowly advances, until it appears almost to touch the hinder surface of the lens.

Up to this point the patient seems to suffer no pain, and there is little, if any, increase of vascularity about the eyeball. Gradually, however, the second well-marked stage occurs: the lens becomes cloudy; so that instead of a clear view of the vitreous chamber being obtained, nothing is seen of the morbid deposit but the indistinct, yellowish reflection which it imparts to the lens. The latter body becomes more opaque, and is slowly thrust forwards against the iris and cornea. Irritability and watering of the eye, with redness of the sclerotic and conjunctiva, now set in, and the child is out of health, fretful, and restless.

Lastly, the eyeball becomes enlarged; the cornea opaque; and the sclerotic bulges at one spot, as if matter were pointing there, or becomes doughy and soft in several parts at once. The chief prominence usually occurs just above the upper margin of the cornea. This third stage of the disease is commonly attended with severe pain.

Thus far it will have been hardly possible, I believe, for the most experienced surgeon to pronounce with certainty as to the real nature of the disease—whether it be *Encephaloid* or *Tuber-*

cular. Most commonly, in either case, the globe bursts, the fluid contents escape, and usually the lens also is expelled; and for a time the patient is almost wholly relieved from pain.

In some scrofulous cases, however, the eyeball, having enlarged up to a certain point, does not burst, but begins slowly to diminish, until eventually it presents almost the same wasted appearance as results from the evacuation of the humors.

Scrofulous disease, after destroying one globe, will sometimes, within a short period, attack the other, and thus reduce the patient to total blindness.

The after-progress of the disease soon affords proof of its real nature. If it be *Scrofulous*, a long-continued discharge takes place from the opening, and then the coats of the globe gradually collapse, and ultimately form a pale, soft nodule, puckered here and there into deep fissures, and frequently presenting some shrunken remnant of almost transparent cornea.

If, however, the disease be *Encephaloid*, a soft, pulpy, vascular fundus soons sprouts forth from the opening which had given vent to the humors of the globe, and rapidly enlarges, having all the well-marked characters of an open cancer. The profuse fetid discharge dries here and there upon the surface of the tumor, so as to give it the appearance of a piece of sponge; and the separation of these crusts is attended with more or less hemorrhage. Eventually the patient dies, either from malignant deposits in the viscera, or from the drain which the tumor occasions, and the repeated attacks of bleeding from its substance.

I have said that *Encephaloid* deposit in the vitreous chamber chiefly occurs in infants and young children. It is, however, met with in adults, but in them is commonly more or less mixed with *Melanoid* deposit.

Melanosis, when it first begins to form within the vitreous chamber, may be unattended with pain or general inflammation of the globe. The patient, perhaps, is first alarmed by the appearance of bright colors, or luminous figures, when in the dark, and afterwards discovers that one eye is defective. It is remarkable to how great an extent one-half of the retina will retain its function, when the other half is completely displaced by melanotic deposit between it and the choroid, so as to form a distinct, rounded mass, projecting from the floor or lateral wall of the vitreous chamber.

Before the invention of the ophthalmoscope, it rarely happened that Melanosis, commencing within the cavity of the eyeball, was detected in this early state of its progress. It was not until the tumor had distended and thinned the sclerotic, so as to exhibit its peculiar dark color, or had ruptured the coats of the globe, and sprouted forth through the aperture, that the real nature of the disease was recognized.

The *Treatment* of Scrofulous and Encephaloid deposits within the globe, consists either in their complete removal, by extirpation of the globe itself, or in the employment of such medical and dietetic means as may, for the longest possible period, support the patient's general health, and in that manner retard the progress of the local disease. For we may lay it down as a rule in the treatment of so-called "malignant" diseases, that the more we are able to invigorate and support the general vital powers of the patient, the slower is the growth of the local disease, and the less tendency has it to involve surrounding tissues.

Extirpation of the eyeball is so easily performed, and it so naturally suggests itself as a means of completely taking away every morbid product which may be contained within the organ, that we cannot wonder at the readiness with which it was undertaken and recommended by the surgeons of former days.

No doubt many of the eyes "successfully" removed by them were affected, not with *encephaloid*, but with *scrofulous* disease, which, as I have said, at a certain stage of its progress, so closely resembles the former. The means of discriminating between these two deposits, which the microscope now affords the surgeon, will bring to the test the real value of extirpation in those cases in which it may henceforward be employed.

Before proceeding to remove an eye for malignant disease, the careful surgeon will of course inquire into the manner in which the various bodily functions are performed, so as to ascertain whether there may probably be any deposit of the same kind in other parts,—the brain, the liver, &c. He will then thoroughly examine the eyeball itself, to be satisfied that the morbid deposit is still inclosed within the limits of the sclerotic; and he may fairly assume this to be the case if the patient can freely move the globe in all directions, while its bulk is little or not at all increased. Such a case may hold out fair hopes of successful removal.

But if the globe, without being itself much enlarged, is thrust forward, or is fixed, or habitually turned in one direction; or if the finger, when pressed in between the eye and the walls of the orbit, encounters resistance, it may be concluded that the malignant growth has perforated the coats of the globe, or that the optic nerve itself is involved in the disease.

If, after removing the globe, the cut end of the optic nerve should be found to contain cancer-cells, a fresh growth of the disease is certain to occur.

CHAPTER XIII.

THE LACRYMAL APPARATUS.

THIS apparatus—consisting of the lacrymal gland and its ducts, the puncta and canals, the lacrymal sac and its nasal duct—is composed of structures so delicate, and changes apparently so trifling are sufficient to destroy the nice balance which ought to subsist between secretion and excretion, that extreme care is requisite in forming a correct diagnosis of lacrymal diseases, as well as much caution in treating them. An over-fondness for surgical manipulation is almost certain to exasperate some of their simpler forms into life-long annoyances.

Watering of the eye (*Epiphora*), under one form or another, is the usual symptom which induces the patient to seek surgical aid. Probably, in some cases, this watering may be due to an actual over-activity of secreting function in the lacrymal gland itself, but it is more frequently the result of some obstruction in the excreting apparatus. If the puncta be wholly impervious, of course the tears must trickle over the cheek as fast as they are secreted. If the puncta or canals be contracted, or strictured, a less complete overflow will take place: if the obstruction be in the nasal duct, the tears, passing freely into the sac, will accumulate there, and form a more or less considerable swelling (*Mucocele*), or they may give rise to inflammation and even abscess. Many of these diseases of the sac, attended with muco-purulent secretion, were vaguely denominated by the older surgeons *fistula lacrymalis;* and this term is still very popularly applied to them. I shall hereafter explain, however, wherein fistula lacrymalis really consists.

When a patient applies to us, complaining of habitual watering of the eyes, we must first notice whether there is any displacement of the puncta. In the healthy state, these little apertures face towards the globe, and are in contact with its conjunctival surface, so that to bring them into view it is necessary to draw the margin of the tarsus slightly away from the eyeball. If, in consequence of Chronic Ophthalmia, the conjunctival lining of the lids has become considerably thickened, the edge of the tarsus is sufficiently everted to cause the openings of the puncta to face upwards, or even forwards; and in that case they can no longer act as capillary tubes in taking up the tears, which, in consequence, trickle over the edge of the lower tarsus. Or the puncta, still retaining their natural position, may have become so completely obliterated, in consequence of long-continued inflammation, that we may be unable to trace their original position.

If, however, the puncta appear to be free, and in their natural situation, and yet no tears can be made to regurgitate through their openings, when the finger is pressed upon the sac, just below the tendon of the orbicularis muscle, we may suspect some obstruction to exist in the canals themselves. To test this, a fine probe ("punctum probe") must be passed along them. This is a manipulation in which the greatest care and gentleness are required, on account of the delicacy of their lining membrane, any rupture or abrasion of which would be followed by stricture; or, if the membrane were extensively torn, complete closure of the canal might ensue. The student must bear in mind the abrupt turn which the canal makes at a short distance from the punctum. In passing a probe into the lower one, for instance, the instrument should be allowed to pass almost vertically downwards for about half a line, and then turned inwards towards the nose, in which direction it will pass—provided it meets with no obstruction—until it strikes against the inner wall of the lacrymal sac. In practised hands, a fine probe without a bulb may be used with advantage when the canal is very narrow, but the beginner should never trust himself to employ any but a bulbous-ended instrument; and even this, as I have said, must be carried forwards in the most guarded and delicate manner. It was formerly recommended to carry on the probe through the lacrymal sac and nasal duct into the nose, so as to dilate any stricture that might exist in those parts; but the instrument employed is, of necessity, so slender, that it cannot be guided with any certainty and precision through so long a passage; and injury to the lining membrane of the sac is almost certain to follow such fruitless attempts. If the obstruction in the sac or nasal duct be complete, and the canals and puncta be free, firm pressure of the finger just below the tendon of the orbicularis muscle, will cause the contents of the sac to escape at the puncta: but if the passage into the nose, although narrowed, be pervious, steady pressure in a direction downwards, and a little backwards, will commonly overcome the resistance of the stricture; the firm swelling caused by the distended sac then suddenly yields, and the fluid passes into the nostril.

In the same way that chronic thickening of the conjunctiva will induce constriction of the punctum, just so will a similar condition of the lining membrane of the nostril cause obstruction or closure of the *outlet* of the nasal duct. Various attempts have therefore been made to dilate from below strictures of the duct and sac, by introducing sounds from the nostril; and tubes have been passed in through the same channel with the object of injecting astringent or stimulating fluids into the cavity of the distended and inflamed sac; but these attempts have ended in disappointment.

I have already partly described the appearance of that distension of the sac which is attended with chronic inflammation of its lining membrane. The fluid which escapes from the puncta, when the sac is pressed, may assume the various appearances of tears thickened with clear mucus, tears mixed with little curdy flakes of a yellowish or creamy color, or a fluid which seems to consist almost wholly of pus.

If care be taken by the patient frequently to empty the sac into the nostril by pressure, the disease may remain for years almost stationary; under a catarrhal attack, however, or from some other cause, it may happen that this chronic affection of the sac suddenly changes its character; pain is felt in the part; the lids become red and puffy—sometimes to such an extent as to assume an erysipelatous appearance, and wholly to prevent the patient separating the tarsi. In this state the swollen sac feels hard and unyielding, and even slight pressure over it causes extreme pain.

If allowed to run on, this inflammation ends in suppuration within the sac; the abscess discharges its contents by bursting just below the tendon of the orbicularis muscle, and the opening in the skin sometimes remains fistulous, allowing the tears which may pass through the puncta into the sac to escape on to the surface of the cheek, thus constituting a true *fistula lacrymalis.* When all inflammation has passed away, and the redness and swelling which attended the bursting of the abscess have disappeared, the fistula narrows to such a small aperture that, were it not for the tears which slowly distil from it, the opening would hardly be perceptible. It is about the size of a pin-hole, and, except that it does not project above the surface of the skin, almost resembles one of the puncta themselves.

The *Treatment* of Distension of the Lacrymal Sac, from chronic thickening of its lining membrane or stricture of the nasal duct, is very tedious. Injections of various fluids, either through the puncta or through the nasal duct, were formerly highly recommended, but have now fallen into disuse. The introduction of a *style*, to be permanently worn in the canal, is a step which should never be resorted to so long as any probability remains of restoring the passage by milder measures. The remedy I have found most serviceable is a little oval blister, about half an inch long, placed directly over the sac. This may be repeated every fortnight or so, according to the state of the skin; and the plan, to be efficacious, must be persevered in for several months. Astringent drops may be used at the same time, but they can reach the sac only in very small quantities, and much diluted with tears, by passing through the puncta and along the canals. Before using them, therefore, the patient should endeavor to empty the sac completely, by pressing his finger upon it in a downward direction.

When Acute Inflammation of the Sac comes on in the manner I have described, the best application is warm water-dressing. Poultices are apt to irritate the skin of the lids, especially in children. Continued warmth and moisture are sometimes so effectual that, within twenty-four hours, not only do the redness and swelling of the lids wholly disappear, but the swollen membrane of the sac is so much relieved, that gentle pressure suffices to empty its contents into the nose, and the case returns to its chronic condition. If the swelling continues unchanged, it must then be freely opened, and treated like a common abscess.

Endless varieties of surgical treatment have been devised for curing the chronic distension of the sac, or the stricture of its duct:—pads, adjusted by means of springs or screws; catgut, introduced into the nasal duct through an incision in the anterior wall of the sac, strings of greater thickness being used as the canal would admit of their passage; metal tubes, which were intended to be healed in, and quietly to occupy the sac and duct, but which Nature, with her dislike to foreign bodies, always rebelled against, and dislodged either upwards or downwards; styles, which should allow of the tears passing along them and so reaching the nostril;—all these contrivances have been tried, and, with the exception of the last, pretty generally abandoned. The chief objection to the style (apart from its unsightly appearance) is, that it requires management and care such as very few patients indeed can, or will, bestow upon it. They neglect to remove and cleanse it regularly, and when it sets up some irritation (as it will occasionally do) they probably remove it altogether, and are unable to replace it. These and other reasons had induced me many years ago to abandon its use.

Mr. Bowman* devised a very simple and useful operation, which in many instances, suffices to cure troublesome Epiphora, while at the same time, it affords a new and ready access to any obstruction that may exist in the course of the lacrymal canal. If, in consequence of chronic ophthalmia, or from any other cause, the lower *punctum lacrymale* has become displaced, so that, instead of facing towards the globe, it is directed upwards or forwards, the tears will run over the edge of the tarsus. In such cases a small probe is to be passed along the whole course of the *canaliculus*, and held steady there, while a fine, sharp-pointed knife, an extraction-knife, for instance, is run along the upper surface of the probe as far as the caruncle, so as completely to lay open the *canaliculus*, and thus, as it were, carry its orifice backwards to the point where the tears accumulate.

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* Med.-Chir. Transactions for 1851, p. 338.

This little operation requires much care and nicety, and is facilitated by using a probe grooved to within a short distance of the end, so as to prevent the point of the knife slipping to one side; or the probe may be dispensed with altogether, and the whole incision made with one of the little blunt-ended knives recently invented for the purpose. For several days after the incision has been made, a probe must be passed along its track, to prevent the lips of the wound growing together.

If a stricture exists in the lacrymo-nasal canal, it may be reached through the now enlarged orifice of the *canaliculus*, through which a probe of suitable size is to be passed till its point is felt to strike against the inner wall of the sac. The probe is then raised into a nearly vertical position, and its point is very carefully carried forwards until it meets with the stricture, through which it is to be passed until its point reaches the floor of the nostril. The frequency with which the probe is to be used depends upon the nature of the stricture.

I would especially warn those who, from this slight sketch of the operation, may imagine that it is easy of performance, and that the subsequent cure of stricture in the lacrymo-nasal duct is to follow almost as a matter of course, to be very careful how they attempt either one or the other manipulation. The passage of an instrument through a stricture in the lacrymo-nasal duct demands even more care and skill than the passage of an instrument through a stricture in the urethra; and I am sure that those who have seen much practice will bear me out in saying that by far the greater part of obstinate and dangerous cases of the latter kind are due to bad surgery, rather than to original disease. The student must bear in mind that the walls of the lacrymal sac and nasal canal are composed of extremely brittle and fragile bones, and that the rough introduction of a probe may either break some of these, or tear away the delicate and vascular membrane which covers them. Besides, as the canal is a bony tube, all thickening of its lining membrane must take place concentrically; and therefore any undue violence, by setting up inflammation, is sure to increase, instead of lessening, the cause of stricture.

Even when all possible care and skill have been employed, cases of stricture of the lacrymal passages are often extremely tedious; for they may be complicated with great dilatation of the sac; caries of the surrounding bones; nasal polypi; or false passages, resulting from some former errors of treatment.

A very rare affection of the lacrymal passages consists in a deposit of the earthy salts contained in the tears, so as to form a calculus. *Dacryolithes* is the name given to these concretions. They have been found in the canals, and in the sac itself. Watering of the eye, repeated attacks of inflammation in the sac, or swelling and suppuration about the canal, and pain when the part is pressed upon, will be the more obvious symptoms. A probe carefully passed into the canal, or through it into the sac, would detect the presence of the concretion, which must be cut down upon and extracted.

Another cause of irritation of the lacrymal passages, is the intrusion of a *detached eyelash* into one of the canals. The hair enters at the punctum, and passes on as far as the abrupt bend which the canal makes at about a line's distance from the opening. Here it is arrested; its point protruding to a greater or less extent, and irritating the conjunctiva and semilunar fold. The symptoms induced are a pricking and itching about the inner canthus, attended with reddening of the conjunctiva. If the eyelash be short, its point will protrude so little beyond the punctum as to make it very difficult of detection. During ten years I noted down the cases in which I had removed eyelashes from the puncta, and found them amount to fourteen—eight being from the upper, and six from the lower aperture. In two of the latter instances I was myself the patient.

CHAPTER XIV.

THE EYELIDS.

THE variety of tissues entering into the formation of the Eyelids, of course subjects them to a great variety of diseases; but inasmuch as these tissues for the most part resemble those found in other organs of the body, and do not present the peculiarities which distinguish the structures of the eyeball itself, there is no occasion, in a work like the present, for treating diseases of the lids with that minuteness of description which is absolutely necessary when speaking of morbid changes in the cornea, the iris, and the lens.

The *orbicularis palpebrarum* muscle is subject to a spasmodic twitching of some of its fibres, usually those spread over the lower lid, producing a visible quivering of the skin of the part, popularly termed "the live-blood." To some persons of an irritable nervous system, it becomes teasing from its frequent recurrence. It is commonly the effect of intestinal irritation, especially that produced by ascarides; and a purge, followed by a little tonic medicine, quinine or iron, suffices to put an end to the annoyance.

The upper lid may droop, so as to interfere with vision by obstructing the greater part of the pupil; or it may fall so as to come into close contact with the lower lid, and render the eye altogether useless. To the latter condition the term *Ptosis* (πτῶσις) is applied; and as it is the effect of a gradual or sudden loss of power in the levator palpebræ muscle, it will be spoken of under the head of *Paralysis of the third nerve.* In some patients who have a congenital drooping of the lids, there seems to be no power of raising them, except by putting into action the occipito-frontalis muscle. The skin of their lids does not present the transverse fold which, in the natural state, is seen to correspond more or less with the upper surface of the eyeball; but the lid, from the eyebrow to the tarsus, is smooth and unwrinkled. The forehead, on the contrary, is furrowed by the frequent compensating action of the occipito-frontalis. It is possible that in some of these cases the levator palpebræ muscle may be altogether wanting.

The term *Epicanthus* has been applied to a slight deformity, sometimes observed in children, which consists in a crescentic fold of redundant skin at the inner corner of each eye, partly or wholly concealing the caruncle. If, in after life, the bridge of the nose becomes prominent, this fold of the skin, to a certain degree, disappears. It has been proposed to remedy in early life this little deformity by pinching up and removing a vertical fold of skin on the median plane just between the eyebrows, and bringing the wound accurately together.

[illegible] tarsal margins of the lids turn inwards [illegible] the surface of the eyeball, the rubbing of the eyelashes on the conjunctiva causes, as may well be imagined, constant irritation and distress. This turning in, whether of the whole or of part of the lid, is termed *Entropion.*

It is met with, especially in elderly persons, as a result of Chronic Inflammation of the palpebral conjunctiva, such as follows neglected or maltreated Purulent Ophthalmia. The curvature of the upper tarsus may become so much increased that the whole range of eyelashes turn backwards against the globe. No doubt this curving of the tarsus is often aggravated by the long-continued application of solid nitrate of silver and sulphate of copper to a granular conjunctiva; and if, in such cases, we evert the upper lid, a pale, smooth cicatrix will be found occupying its deep concavity. Injuries to the eyeball from lime, acids, &c., also produce contractions of the conjunctiva, which may draw inwards a part or the whole of the ciliary margin of the lids.

Inversion of the lower lid is not uncommon in old persons, in whom the skin is loose and the tarsal cartilage flaccid. Under some temporary irritation of the eyeball, the fibres of the *orbicularis palpebrarum* are put into frequent action, so that on some occasion the lower tarsus becomes tilted quite against the eyeball; this irregular action is repeated until at last the lid becomes so rolled upon itself that both the cilia and tarsus are completely hidden from view, and the border of the lid is formed by the common integument. In these extreme cases of Entropion, the irritation is much less than in those in which the inversion is only to a slight degree. For, in the latter instance, the points of the cilia are brought into direct contact with the globe, whereas in the former case the tarsus rolls over so completely that the points of the cilia are buried in the fold of palpebral conjunctiva, and consequently do not come into contact with the globe.

Occasionally one meets with *Spasmodic Entropion* of the lower lid in children the subjects of irritable Ophthalmia, and this inversion of the eyelashes greatly increases their distress. Contractile collodion applied to the skin of the lid counteracts the tendency of the part to turn in, and gives time to other remedies to subdue the irritability which had given rise to it.

Inveterate cases of Entropion in old persons can be radically cured by removing a suitable portion of the skin of the lid, together with the fasciculus of muscle beneath it, and then accurately uniting the wound with sutures. It is a matter of much nicety exactly to calculate the extent of skin to be taken away, and of course the removal of too large a quantity would produce a deformity of an opposite kind, namely, eversion, or *Ectropion.* If the tarsus be so morbidly curved that removal of skin will not suffice to draw the eyelashes away from the globe, the whole row may be dissected off.

In Ectropion, or turning outwards of the lid, the palpebral conjunctiva is always more or less reddened and uneven; recent inflammatory cases presenting a florid and villous surface, while chronic cases have a more congested and coarsely granular aspect.

In Purulent Ophthalmia of infants, and in Scrofulous and Irritable Ophthalmia of older children, the swollen lid may become suddenly everted, either by the spasmodic action of the *orbicularis palpebrarum*, or by the efforts of those who are endeavoring to examine the eye. The appearance thus produced frequently gives rise to much alarm; but as the inflammation subsides, the deformity gradually disappears, without requiring any operation. This, however, is not the case in the chronic forms of Ectropion, which is slowly produced either by granular thickening of the conjunctiva following Purulent Ophthalmia, or by the contraction of cicatrices in the adjacent skin, resulting from burns, ulcers, disease of bone, &c. These deformities are so various, and require such manifold forms of operation (which can hardly be made intelligible without the aid of figures), that I must refer the reader to the treatises of MACKENZIE and WALTON,* where drawings are given both of the deformities and of the operative plans for their cure.

When isolated groups of eyelashes grow irregularly, so as to turn against the surface of the globe, the disease is called *Trichiasis*. It is sometimes difficult to decide whether a case of displaced

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*** On Operative Ophthalmic Surgery, 1853. In this work the reader will find several well-executed figures of Entropion and Ectropion, with the appearance of parts during and after the operation.**

cilia should be distinguished by this term, or by that of *Entropion*. The former term, however, is properly limited to those cases in which, while the general outline of the tarsal cartilage is natural, the eyelashes are displaced in consequence of small cicatrices about their roots, as in the disease known by the name of *Tinea Ciliaris*, which affects the edge of the tarsus. Sometimes three or four eyelashes have their points directed against the globe, or even a single hair will grow in this direction, while all the rest maintain their natural position.

I had a woman under my observation for many years who suffered from a form of Trichiasis, resulting from the peculiar nature of the hairs themselves. They were almost white, very fine and weak, and twisted together almost like the fibres of singed wool. They got tucked under the margins of the tarsi, and gave rise to considerable irritation. The hairs of her eyebrows and head had much the same character as the eyelashes.

If only a few hairs are displaced, the removal of the entire row must not be resorted to, but the offending ones must either be carefully plucked out from time to time, or the entire group removed by dissecting out the little portion of lid, external to the tarsus itself, in which their roots are implanted, and uniting the edges of the skin-wound. Where a single hair, or two or three hairs, are faulty, it has been recommended to inoculate the bulbs with tartar emetic in powder, or to destroy them with a redhot needle, set in a ball of metal to preserve the heat.

To draw out eyelashes by the roots seems a very simple matter, and yet there are few surgical manipulations in which skill and a well-made instrument are so much needed. Most of the cilia-forceps one meets with are so made that they cut through the hair, instead of merely grasping it firmly; and I need not say that a stiff, broken stump causes infinitely more pain to the patient than the fine, natural point of an unbroken hair.

INFLAMMATION OF THE LIDS.

The eyelids are of course subject to œdema, erysipelas, abscess, and the various forms of inflammation which attack other parts of the common integument; and I have already alluded to the redness and swelling which especially attend acute inflammation or suppuration of the *sac* in cases of obstructed nasal duct. There are, however, a few forms of inflammation which demand notice, on account of their presenting peculiarities of appearance, or being distinguished by special names.

A Sty (*Hordeolum*) begins as a small, red, tense swelling, at the very edge of the lid, close to the root of one of the eyelashes. At first it is chiefly troublesome by its itching. As it increases, the lid becomes stiff and painful, and in some cases assumes throughout a considerable degree of redness and swelling, so that the eye becomes completely closed. In a few days, matter begins to show itself at the most prominent point of the sty; the skin gives way; a small quantity of pus and sloughy areolar tissue escapes; the redness and swelling of the lid subside; and the part gradually resumes its natural appearance.

Stys are very common in scrofulous and delicate children, and comparatively rare in adults. Except a slight puncture through the cuticle, with the point of a lancet, when the pus is pointing in a large sty, no incision or handling is necessary or advisable; warm water-dressing, and frequent fomentation, comprise all the local treatment. The patients are, as I have said, almost always out of health, and require attention to the bowels, careful diet, and tonics.

I observed, when speaking of *Trichiasis*, that one of the commonest causes of this displacement of the eyelashes was *Tinea Ciliaris*. This disease—termed also *Ophthalmia Tarsi* (MACKENZIE), *Psorophthalmia*, *Lippitudo*, *Tinea Palpebrarum*—is too often neglected in its early stage, when alone it is curable; and the surgeon is not appealed to until many of the hair-bulbs have been irreparably destroyed, and the hairs distorted and inverted (*Trichiasis*). Or the case may be neglected until all the hairs, except perhaps a straggling one here and there, have disappeared, and the edges of the lids, red, shining, and partly everted, give to the patient the most repulsive aspect. It is useful to distinguish by different names that condition in which active disease is still going on at the roots of the eyelashes, and that in which they have been destroyed, and the lids reduced to the state I have just described; and we may restrict the term

Tinea Ciliaris to the first condition, and call the second *Lippitudo.*

We rarely have an opportunity of seeing *Tinea Ciliaris* in its early, pustular form; for the little pustules which are scattered along the margin of the lids soon break, and the discharge exuded from them forms crusts, which cling about the eyelashes, and, in severe cases, almost hide them from view. If the disease is suffered to run on unchecked, it continues for years to infest the roots of the hairs, until the tissues which secrete them are totally destroyed. Then, when all active disease is at an end, and the last remaining crusts have been shed, the tarsi, instead of presenting sharply bevelled edges, appear rounded off, the skin and conjunctiva being gradually blended together into one smooth, red, shining cicatrix, in which neither Meibomian orifices nor cilia can be traced. Very commonly the puncta lacrymalia have also become closed, and the tears in consequence trickle over the cheek, and produce a constant irritability and blinking of the lids.

The chief difficulty in treating cases of *Tinea Ciliaris* arises from the age of the patients, and their unwillingness to submit to the necessary discipline. Constant attention is required to prevent the accumulation of crusts, which should be carefully washed off night and morning. Our out-patients frequently derive but little real benefit from the ointments prescribed, in consequence of these preliminary cleansings being omitted: the salve is roughly smeared over a thick accumulation of crusts, and perhaps, at the same time, fragments of the latter are left upon the eye itself, together with some of the stimulating ointment.

Of course, it is useless to apply the ointment anywhere except upon the very surface of the minute sore; and, to insure this being done, every particle of crust must previously be removed. The ointment must then be neatly pencilled in wherever a raw surface can be detected. Where this careful manipulation cannot be insured, it is better to prescribe a lotion, as that can hardly fail to reach the seat of disease, if it be used often enough. The Unguentum Hydrarg. Nitratis, Ung. Hydrarg. Nitrico-oxydi, or Ung. Zinci Oxydi, much diluted with *fresh* lard, are the salves in common use; and a solution of Acetate of Lead in distilled water (gr. ij—iv ad ℥j) is perhaps the best form of lotion.

In the worst forms of *Lippitudo*, the surgeon can do but little to remedy the unsightly appearance. A stick of nitrate of silver, lightly brushed over the very edge of the lids, will sometimes render them less irritable; and if the tears can no longer be taken up, in consequence of displacement of the puncta, these apertures may be slit in the manner described at p. 270.

The Meibomian follicles—which pour out upon the edge of the tarsi a greasy matter, to prevent the tears running over, and to cause them to flow onwards to the inner canthus and puncta—sometimes become slightly obstructed at their orifices, and then the secretion, becoming solidified, forms a minute granule, looking like a grain of sand upon the edge of the tarsus. If it projects sufficiently to touch the conjunctiva of the globe, it produces slight irritation, and gives the sensation of a small foreign body in the eye. A touch with the end of a probe is sufficient to remove it.

A small *Abscess* may form in the Meibomian follicle itself. It usually is met with in the lower lid, commencing with a small patch of vascularity in the palpebral conjunctiva, close to the free border of the tarsus. After some time there appears in the centre of the red patch a yellow dot, evidently produced by a minute quantity of pus just beneath the conjunctiva. If the part be punctured with a lancet, and the scoop of a fine probe introduced, the exciting cause of the suppuration —a little nodule of stearine—may be turned out, and all irritation at once ceases.

PHTHEIRIASIS.

This term is employed to denote the breeding of *crab-lice* among the eyebrows and eyelashes. The affection must be extremely rare, at least in this country, for among the thousands of patients who have come under my care at the Ophthalmic Hospital, Moorfields, I have seen but two cases of the kind; and I know of three cases only which have been observed by my colleagues.* It is possible, however, that some may have been overlooked, on account of the strong resemblance such cases bear to the slighter forms of *Tinea Ciliaris.*

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* From one of these the drawing was taken which appears in Dalrymple's work, pl. vi, fig. 6.

The first patient I saw was a healthy-looking child, four years of age; well fed, cleanly in general appearance, and perfectly free from vermin in other parts of the body. The eyelids, also, on the right side were free from disease. Those on the left were very slightly reddened at the edges; the cilia presented a powdery appearance, and their roots seemed to be clogged with such yellowish-gray and brown crusts as are met with in early cases of *tinea.* These crusts (as they seemed to be) were very small, and might easily have been passed by, as presenting nothing uncommon. Their beaded form made me look more closely, and I then recognized their real nature from the movements of the insects. I placed some under the microscope and identified them as crab-lice (*Phthirius*, LEACH), a species perfectly distinct from the common louse (*Pediculus*). They appear to thrust in their heads beside the roots of the cilia, and by means of the sharp claws, with which all their legs, except the first pair, are furnished, hold on so firmly that they cannot be dislodged without much difficulty. The child had been troubled for many weeks with these creatures, which, however, had not invaded even the eyebrow on the same side.

I ordered Unguent. Hydrarg. Ammonio-chloridi to be smeared upon the eyelashes every night, and this seemed to destroy such of the insects as

I had not at first been able to dislodge with the forceps.

TUMORS.

The following are met with in and upon the eyelids:

1. *Cysts* (connected with the tarsal cartilages), which have been variously designated as *Chalazion* (MACKENZIE), or as *Encysted tarsal tumor* (TYRRELL).
2. Solid growths on the skin, termed by TYRRELL *glandiform*, and by MACKENZIE *albuminous* tumors, but which seem to be identical with *Molluscum*.
3. Little watery bags, found in old people along the cuticular edge of the lid.
4. *Warts*, differing in no respect from those in other parts of the body.
5. *Nævi materni*, which likewise offer nothing peculiar.
6. Strong, fibrous, subcutaneous *Cysts* (containing epithelium and hairs), which are almost invariably found at one spot—namely, the outer extremity of the hairy eyebrow.

1. The *Cystiform Tumor* of the tarsus is very common. It may occur singly, or there may be several cysts at the same time, and in both lids. When small, the tumor is hardly recognizable except by the touch, as the skin over it is quite unchanged. It feels like half a hemp-seed, or half a pea, fixed by its flat side to the tarsal cartilage, and presenting its convexity to the skin, which may be slipped freely over it in every direction.

It seldom exceeds the size of a large pea, except in the case of suppuration taking place within its cavity.* If the lid be everted, the part to which the tumor is fixed will be recognized by the tarsus appearing to be thinned, so as to present a slightly dark spot, around which the conjunctiva is rather vascular. These cysts may remain of a moderate size throughout the patient's life, and cause no inconvenience; but sometimes they suddenly inflame and enlarge; the skin over them becomes reddened, and at last gives way, and allows a small quantity of pus to ooze out, and a thin sanies then continues to drain from the aperture. More frequently it is the conjunctiva which gives way, and then a litle red, soft, fungous mass gradually protrudes, which, by being continually pressed against the eyeball, becomes flattened out into a button or mushroom shape.

If these cysts are small, and do not inflame, it is needless to meddle with them. If, however, they acquire such a size as to become observable, or if they inflame and suppurate, they must be treated as follows: the lid being everted, a little crucial wound is made through the conjunctiva and thinned tarsus into the cavity of the cyst, with a lancet or cataract knife; a little serum and pus escapes; then a scooped probe is passed into the cyst, and twirled about in various directions, so as to empty out all the accumulated epithelium, which looks almost like half-melted size. Blood fills the cyst, and makes it as large as it was before the incision. The patient may be assured, however, that this swelling will gradually subside. It will be necessary to break up the contents of the cyst, and prevent closure of the opening, by reintroducing the probe twice or thrice during the following week. By that time the walls of the cyst will have come together, and nothing will remain but a slight thickening, just perceptible by the finger applied to the skin of the lid.

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* Dalrymple; pl. iv, fig. 2, shows very well the appearances of a full-sized Cystiform Tumor. The drawing must have been made from a case in which suppuration had begun; otherwise, the skin would be of its natural color.

2. The little masses termed by MACKENZIE *albuminous*, and by TYRRELL *glandiform, tumors*, are met with in children, on the lids, the alæ of the nose, and near the angles of the mouth. Those about as large as a hemp-seed are smooth, shining, and slightly reddened; when they attain to the size of a small pea they are whitish, and exhibit at the apex a little opening, through which a milky fluid exudes on pressure.* The most effectual way to get rid of them (though it appears rather a rough and barbarous process), is for the surgeon to secure the child's head between his knees, to split all the little tumors through with a lancet, and then to nip out the contents of each between his nails. The appearance of the mass is very similar to that of a fragment of pancreas, or salivary gland.

3. The little, thin, *watery bags*, about the size of a hemp-seed, which are found along the edges

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* Dalrymple; pl. iv, fig. 3. A good representation of these growths, which, however, are rarely seen of such large size.

of the lids in old persons, are hardly worthy of notice. They may if thought desirable, be removed by snipping off their prominent part with scissors.

4. *Warts* may be treated in the same manner, and the wound touched with nitrate of silver.

5. *Nævi* of the lids differ in no respect, as regards appearance, from those found in other parts of the body. They only require more careful treatment, on account of the importance of avoiding, as much as possible, any extensive loss of skin; as a large cicatrix might induce Ectropion, or some other deformity. Subcutaneous ligature, therefore, or the introduction of probes coated with fused nitrate of silver, must be preferred to including any considerable portions of skin within the ligature, or extensively applying escharotics. I have seen injections of alum cause sloughing of the lids and great subsequent deformity.

I had a case under my care in which the injection of a solution of tannin answered extremely well. A young lady was brought to me with a nævus on the upper lid, about as large as a small hazel-nut. I was told it had been twice operated upon by the introduction of "threads steeped in acid," and that much inflammation and sloughing followed. Indeed, there was a considerable cicatrix of the skin near the outer canthus. The apex of the swelling was near the free margin of the lid; on everting the latter, a small, red bunch of veins, about the size of a barleycorn, was seen projecting through the tarsal cartilage. The nævus seemed to be formed almost wholly of veins, the larger trunks of which could be felt through the skin, just below the supra-ciliary ridge.

I inclosed the whole substance of the lid in a "ring-forceps," and thus completely isolated the nævus from its parent veins. Then, I punctured it with a very small narrow knife, and cut up its tissue subcutaneously. The nævus of course collapsed when emptied of blood, and I next threw in, with an ANEL'S syringe, a saturated solution of tannic acid in water. After a short pause, I relaxed the pressure of the ring-forceps, and allowed the current of blood to return and come into contact with the injected fluid.

The inflammation which followed produced a good deal of swelling and hardness of the lid, but the only slough was a mass about the size of a small pea, which came out, like the core of a boil, at the little wound.

The last time I saw the patient, seven weeks after the operation, the cure seemed to be complete. The form of the lid was just like that of the sound eye; but there was a good deal of livid discoloration beneath the skin, the result of extravasated blood. No trace remained of that small portion of the nævus which had perforated the tarsal cartilage.

6. I am not aware of the reason why the strong *fibrous cysts*, containing sebaceous matter and hairs, which form beneath the skin of the eyebrow, should almost invariably be found to correspond to its outer extremity; but such is the

case. I believe they are usually congenital; at least, I have seen them of considerable size in infants of four or five months. They cause a prominence of the skin, the color of which, however, is quite unchanged. They are to a certain extent movable upon the edge of the orbit, and the skin seems to be slightly adherent to them at one point. They vary from the size of a large pea to that of a hazel-nut. When dissected out, they are found to be composed of a strong fibrous cyst, with a smooth lining membrane; and the cavity is filled with white, greasy matter, interspersed with hairs. In a cyst removed from an infant of five months I saw these hairs still attached to the lining membrane. In older children and in adults they are always loose. I removed from a woman between thirty and forty, a cyst, the skin over which had become so much thinned as to have assumed a slightly blackish hue. In endeavoring to dissect out the cyst, I punctured it, and there escaped a quantity of perfectly clear, yellowish oil, into which all the sebaceous matter secreted seemed to have been converted. When the cyst was removed, nothing was found within it but some detached hairs, loosely curled together, and as strong and dark as those of the head.

INJURIES.

The appearance of an *Ecchymosis* of the lids—popularly, a "black eye"—is too familiar to require description. As regards the best mode of treatment, I know of none equal to that handed down by the traditions of pugilism, consisting in the application of a poultice formed of the scraped root of the black bryony (*Tamus communis*) mixed with linseed-meal or bread crumbs. This produces a stinging sensation in the skin, and effects a very speedy disappearance of the effused blood.

Emphysema of the Lids may fitly be spoken of in immediate connection with Ecchymosis, for both very frequently arise from the same cause —namely, blows with the fist; indeed, I have never seen Emphysema occur in any other way. Shortly after receiving such an injury, the patient happens to blow his nose, and is surprised to find the eyelids suddenly puff up, so that he is unable to separate them. The swelling is unattended with any redness of the skin, and, on pressing the part with the fingers, the surgeon at once perceives the peculiar crackling of air effused into areolar tissue. It resembles the sensation we experience in compressing a portion of healthy lung between our finger and thumb.

The cause of this *Emphysema* is rupture of the lining membrane of the nose, with fracture of the lacrymal, or perhaps the ethmoid, bone; and, until the fissure has closed, the Emphysema is apt to recur if the patient blows his nose. If he abstains from doing this, the effused air soon becomes absorbed without any special treatment.

I need not enter into any particular description of *Wounds of the Eyelids ;* for they differ in no respect from wounds of other parts of the integument, and offer no difficulties of diagnosis. I would only allude to the importance of securing the nicest and most accurate adaptation of cut surfaces in parts so open to observation. The fine and yielding nature of the skin of the lids and its rich supply of blood, offer peculiar facilities for obtaining close and smooth union of wounds by means of fine sutures, in applying which the greatest care must be taken to avoid any irregularity and puckering of the cut edges.

Carcinoma commencing in the lids is a rare disease. If it be already far advanced when the surgeon is first applied to, extirpation would hardly be attempted. If recognized in the early state, as a small, hard, tubercular mass at the margin of the tarsus, a V-shaped portion of the lid may be removed.

Epithelial Cancer chiefly affects the skin just over the lacrymal sac, extending from the inner canthus downwards over the nasal bone, having the appearance of a shallow ulcer, with an irregular outline, and everted borders; its surface being pale, with a scarcely perceptible amount of secretion. Chloride of zinc, applied as a paste over the entire surface of the sore, but especially upon its margins, very effectually destroys the growth; and it may be repeated as often as any part of the border appears inclined to extend itself. Strict attention would of course at the same time be paid to the general health of the patient.

CHAPTER XV.

THE ORBIT.

DISEASES OF PARTS SURROUNDING AND ACTING UPON THE EYEBALL.

In the present chapter, parts very dissimilar, as regards their structure and functions, are grouped together; but inasmuch as, in a healthy state, they all either *support* or impart *motion* to the Eyeball, any morbid change in them, or any tumor in their immediate neighborhood, must cause *displacement* of the organ, or *impairment of its mobility;* and these are the symptoms which, in orbital diseases, first attract the notice of the surgeon.

PROTRUSION OF THE EYEBALL.

(*Proptosis oculi;—Exophthalmos;—Ophthalmoptosis.*)

It must be self-evident that this cannot take place to any great extent without the sight becoming impaired by the stretching of the optic nerve. Both globes may, however, appear somewhat too prominent, in consequence of an overgrowth of fat in the orbits. I have seen a similar overgrowth occur in the lids.

A more marked deformity is that which is met with chiefly in feeble and hysterical women, in whom the eyes appear much too large for their sockets. The tarsi can be brought completely together, and the eyes themselves can be freely moved in all directions. The equal amount of prominence in both eyes, and their unimpaired function, both of sight and movement, would do away with any suspicion of orbital tumor.

The cause of this deformity is obscure. Atony of the recti muscles might produce a certain amount of prominence, but is hardly compatible with such free motion as usually exists; and a shortening of the *levatores palpebrarum*, such as would account for much of the seeming prominence, would hardly allow of complete and easy closure of the eyelids. As far as I have seen, the deformity is never cured.

I may here notice an apparent, rather than a real, displacement of the eyeball, which is the result of accident, and which gives rise to much alarm in those who witness it for the first time. It consists in the complete lodgment of the upper lid behind the greatest convexity of the globe.

If a patient in whom the eyeballs are naturally prominent, and the eyelids flaccid, or in whom some small orbital tumor may slightly thrust the globe forwards, be too forcibly examined by the surgeon, anxious to explore the upper surface of the sclerotic, it is possible that the tarsus may suddenly slip over the greatest convexity of the globe, and become fast locked behind it. This is probably the accident which is mistaken for Dislocation of the Eyeball itself, in those cases, so often *heard of*, in which the friends of the patient assure us that "his eye was knocked out of the socket, and hung on his cheek, and that it was put in again, and he saw as well as ever." A wire speculum (PELLIER'S), or a bent probe, will enable the surgeon to lift up the tarsus and restore it to its place.

The Eyeball may be slowly displaced by various morbid growths—*Hydatids*, *Cancerous deposit* within the cavity of the orbit, or *Exostosis* from its walls.

At first the globe becomes gradually protruded in a direction corresponding to the position of the mass which is acting upon it, and as the tumor increases, the globe becomes immovably fixed in the orbit. It is sometimes possible to pass in the little finger between the globe and the bony walls surrounding it, so as indistinctly to explore the position of the tumor; but the extent of such

Abscess in the areolar tissue of the Orbit is most commonly a sequel of erysipelas or fevers; it may, however, occur as a result of injury, such as the entrance of a foreign body. Some prominence and loss of mobility of the eyeball; redness of the conjunctiva, and infiltration of the areolar tissue beneath it, with marked redness and swelling of the lids, and ultimately, fluctuation, are the distinctive signs of Orbital Abscess; and the comparative rapidity with which these signs follow each other, at once distinguishes suppuration from the growth of tumors.

Until the occurrence of fluctuation, the diagnosis of inflammation of the orbital areolar tissue is obscure; and the incisions which some writers advise to be made, before suppuration has plainly shown itself, seem very unsafe, when we consider how closely the eyeball is surrounded with muscles and nerves, which it would be dangerous to wound, and which could hardly escape such deep punctures as are recommended.*

Chronic Abscess in the Orbit may occur as the result of caries, or necrosis; in which case a probe, passed into the opening through which the pus has been evacuated, will detect the denuded bone.

Orbital Abscesses, even of the more acute and phlegmonous kind, so commonly occur in debilitated and depressed subjects, that opiates and moderately nutritious diet will be much more frequently indicated than bleeding and abstinence. Tonics and stimulants—such as bark, wine, &c.—are frequently required to a considerable amount, in those cases in which free suppuration has followed the opening of the abscess.

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* Tyrrell says (Practical Work, &c., vol. ii, p. 206), "I do not hesitate to make deep and free punctures, either between the eyelids and globe, or through the eyelids."

The various faulty positions of the eyeball which are comprised under the general head *Strabismus*, may be due either to a morbid condition of some of the ocular muscles, as regards associated action, or to paralysis of the nerves supplying them.

The reader will do well to call to mind the distribution of these motory nerves:

The *third* goes to the levator palpebræ, the superior, inferior, and internal, recti, and the inferior oblique, muscles; and to the iris, through the medium of the ophthalmic ganglion. The *fourth* supplies the superior oblique muscle; the *sixth*, the external rectus.

A patient presents himself, unable to lift the upper lid. We raise it, and expose the globe, which we find more or less abducted, so that the cornea, instead of holding a middle position, turns outwards towards the temple. By his own efforts the patient can direct the eye still farther outwards; but neither upwards, downwards, nor inwards. The pupil is immovable, and somewhat dilated.

If with both eyes he looks at objects placed on that side of him towards which the eye is abducted, they appear single; while those in the opposite direction appear double. When the affected eye is used by itself, objects are seen singly, although less distinctly than with the sound eye.

The function of the *third nerve* is suspended, that of the *sixth* retained; and therefore the external rectus muscle, to which the latter nerve is distributed, having no active antagonist, draws the eye outwards. Such are the appearances in a case of *total paralysis of the third nerve.*

Another patient presents himself with "*Internal Strabismus*," one eye being turned in towards the nose. The movement of the lid is natural; he can direct the affected eye upwards and downwards, and can, perhaps, with an effort, still farther increase its inversion. The pupil is of natural size, and active. If with both eyes he looks at objects on that side of him towards which the eye is inverted, they appear single; if he looks in the opposite direction, they appear double. He is the subject of *total paralysis of the sixth nerve.*

It is not necessary that *all* the branches of the third nerve should be paralyzed at the same time, or in an equal degree. There may be no falling (*Ptosis*) of the upper lid, and only a very slight abduction of the eyeball, the power of the internal rectus being weakened,—not lost. Or, the superior or inferior rectus alone may be affected, and the iris may perfectly retain its mobility.*

Or again, the *third* and the *sixth* nerves may *both* suffer at the same time. In that case when the surgeon raises the lid, he finds the pupil dilated and fixed, and the cornea in a perfectly central position, from which the patient cannot, by any effort, move it in the slightest degree.

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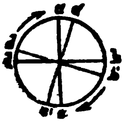
* Paralysis of the motory nerves of the iris has been spoken of under the name of Mydriasis.

The Oblique Muscles.—The reader will remember that the inferior oblique muscle is supplied by a branch of the *third nerve;* consequently when the whole of that nerve is paralyzed, the action of the inferior oblique ceases; and the superior oblique, which receives a special nerve of its own,—the *fourth*,—having no longer any active antagonist, rolls the globe on its antero-posterior axis,—or rather on an axis the poles of which correspond to the centre of the cornea and of the optic nerve.

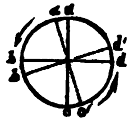
In like manner, when the *fourth* nerve alone is paralyzed,—which sometimes occurs,—the inferior oblique, being uncontrolled by the superior, rotates the eye in the opposite direction. In either case, the result is double vision; the image seen by the affected eye being, at the same time, oblique.

Figure B illustrates the change of position which the right cornea of a patient would undergo in consequence of simple paralysis of the fourth nerve. The inferior oblique muscle being unimpaired, would rotate the cornea, so that the points at its circumference, *a*, *b*, *c*, *d*, would shift to *a′*, *b′*, *c′*, *d′*.

The action of the obliqui muscles is, as I have just observed, to roll the eyeball upon its antero-posterior axis; the objects of these movements being to insure that, during lateral inclination of the head, the vertical diameter of one eye should be kept always parallel to the other.



A



B

If, then, we look at the right eye of a patient (A), in whom the third nerve on that side is totally paralyzed, while the fourth nerve has retained its function; and if we imagine his cornea to be marked with two straight lines intersecting each other at right angles opposite the centre of the pupil,—we shall find that whenever he makes an ineffectual effort to depress the eye, it is slightly rolled upon its axis, by the superior oblique muscle, in such a manner that the points *a*, *b*, *c*, *d*, would assume the positions indicated in the diagram by *a′*, *b′*, *c′*, *d′*.* This muscular action cannot be kept up, but may be frequently repeated with a short, twitching motion. If such a patient looks at a near object with both eyes, a large letter in a book for instance,—say a T—at such an angle that it appears double, the image perceived by the affected eye will be inclined from the perpendicular, so as to be seen by him thus, , and it is only by inclining his head towards his shoulder that the image can be made to appear parallel to that perceived by the sound eye.

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* I had frequent opportunities of making this experiment with a patient in whom the third nerve was wholly, and the sixth partially, paralyzed, in consequence, I believe, of thickening of the dura mater about the outer wall of the cavernous sinus. The fourth nerve seemed, in some way, to have escaped injury.

Paralysis of the fourth nerve (superior oblique muscle) rarely occurs alone; but I have met with a few cases in which it appeared to me to exist independently of any other nervous derangement. The diagnosis of such a case requires a great deal of careful investigation, for little or nothing is to be learnt by a mere casual inspection of the eye; and unless the patient is intelligent and able to appreciate the surgeon's object in making his experiments, little insight into the real nature of the disease is afforded.

One of the most useful aids to diagnosis is obtained by desiring the patient to trace over with a pencil the two images of the letter or mark (T or +) which may have been selected as a test. It is evident that the vertical line of the mark will suggest to the patient the same line of obliquity, whether the paralysis exist in the *right inferior* oblique, or the *left superior* oblique, muscle.

The defect of vision arising from palsy of the obliqui is very evident when the patient fixes his attention on some straight line on the ground; for instance, the edge of the curb-stone in the pavement, or of a gravel walk. In each instance, he sees two paths; one in its true position, the other forming with it an angle more or less acute.

To determine the exact pathology of these paralytic affections of the orbital nerves, a very careful and patient course of inquiry is needed. Chronic changes in the brain itself, or in the dura mater;· the growth of tumors in either of these parts; disease of bone; all these processes may give rise to *slow*, and eventually total, paralysis of one or all of the nerves which enter the orbit. Their functions may be *suddenly* suspended in consequence of apoplectic effusion, or other injury to the brain; or the paralysis may be as complete, and as sudden, and yet may eventually pass away, without the slightest impairment of function remaining; the cause having been rheumatic inflammation of the fibrous tissues immediately surrounding or investing the nervous trunks. The whole history of the case must be well weighed, before the surgeon can make up his mind to which of the causes I have enumerated he is to attribute the paralysis; and I need not say how deplorable a mistake may be committed by his overlooking, or misinterpreting, obvious and important symptoms.

Strabismus.—Although most of the forms of paralysis affecting the orbital nerves produce malposition of the eyeball, the term "Strabismus" is commonly restricted to those cases in which overaction of one of the recti, or enfeebled action of its antagonist, has become *habitual.*

A "squint" is a deformity too familiar to require much description for enabling the student to recognize it. It may be best defined as a want of parallelism in the visual axes when the patient endeavors to direct both eyes to a distant object at the same time.

The most frequent form of squint is that in which while one cornea appears to be steadily directed towards objects, the other turns in towards the nose. If, in such a case, the better eye be closed, the other immediately rights itself, and assumes a proper direction, becoming again inverted as soon as its fellow is reopened.

A rarer form is that in which one eye is habitually directed outwards—*external* or *divergent*, Strabismus. Here, too, the faulty eye assumes a proper position whenever the other eye is closed.

Internal Strabismus rarely exists to the same extent in both eyes; in most of the cases which at first sight appear to be of this nature it will be found, on careful examination, that the extreme inversion is alternating; first one eyeball, and then the other, being more forcibly adducted.

The inversion in one eye is often so much in excess of that in the other, that a superficial examiner may conclude Strabismus to be limited to one eye only, whereas it really involves both, although in very unequal degrees. If a card or similar screen be placed before the less affected eye, while an object is attentively regarded with the evidently inverted one, the surgeon will find that the less affected and previously unsuspected eye turns inward. In such a case both internal recti muscles will require to be divided.

An eye which habitually squints, if separately examined, will usually be found defective as regards vision. This inequality frequently exists to a remarkable degree; so that, while the patient can read the smallest type with the habitually straight eye, he can with the habitually squinting one barely distinguish a printed from a blank page. It sometimes happens, however, but very rarely, that the sight of an eye thus habitually squinting is almost perfect.

The cause of Strabismus is often very obscure. It usually shows itself during early childhood, and in many instances is attributed to the irritation of the brain which attends teething. Intestinal irritation, with development of worms, is a very frequent accompaniment of that partial squint which alternates from one eye to the other. An opacity near the centre of the cornea will sometimes cause the eye gradually to turn inwards, as if Nature were making an effort to bring the clear portion of the cornea into use.

DONDERS regards Hypermetropia as being the exciting cause of Strabismus in the majority of cases, and says that it is rare in persons affected with Myopia.

The *Treatment* of Strabismus will, of course, vary with the cause. The removal of intestinal irritation; the use of tonics; abstinence from fine and trying work; the employment of glasses to correct hypermetropia, or myopia; all these, and many other means, might be enumerated as likely to remove a Strabismus which is temporary, or which occurs only when the eyes are used in some particular manner.

Before resorting to any operation, every possible care must be taken to ascertain that no organic disease is going on in the brain or orbital nerves; that there is no tumor in the orbit, mechanically interfering with the movements of the eyeball; that the squint does not result from mere paralysis of the muscle which is the antagonist of that towards which the eye is turned; and that the retina possesses a certain amount of visual power.

The use of the ophthalmoscope should always be resorted to before an operation is performed. For some years past I have examined in this way nearly all the cases of Strabismus which have come before me, and have detected a great variety of morbid changes in the deep tissues. In some instances, these changes were so considerable as to put all hope of improving vision quite out of the question, and yet no external sign of disease existed except the faulty position of the eye. In most cases there was marked impairment of sight in the more squinting eye, and the ophthalmoscope showed the optic nerve to be smaller than natural, and of a more or less dull gray tint.

The operation for the cure of squinting, by division of the recti muscles, was, on its first introduction, so extravagantly praised, and so indiscriminately practised, that, by a natural reaction, the current of opinion has, to a considerable extent, turned against it; and the numerous cases in which it has failed to do good, or has even produced a deformity worse than the original one, are brought forward to prove that all surgical interference is mischievous.

Reserving for a future chapter any description of the operation itself, I may here notice an appearance which a patient may present some considerable time after its performance. The operated eye, even if not strongly turned outwards by the preponderating action of the abductor, projects in a peculiarly unsightly manner, and has little or no power of adduction.

On close inspection it will be found that the semilunar fold and caruncle have almost disappeared; and these parts are sometimes so little visible, that the eye very much resembles an artificial one. This unpleasant appearance is caused by a too extensive separation of the conjunctiva from the sclerotica having taken place in the attempt to expose the tendon.

OPERATIONS.

In the following remarks concerning some of the more important Operations practised on the Eye, I have endeavored to confine myself to such a general description as may render the principles upon which they are founded intelligible to the student, rather than to give him minute directions for every manipulation which their accurate performance may demand.

There are so many points of detail to be borne in mind during the Extraction of a Cataract, or the formation of an Artificial Pupil, that almost every case becomes a study in itself. The most labored written instructions will never suffice to form a skilful practitioner, nor confer that presence of mind, and readiness to take advantage of circumstances as they arise, which, although required in every branch of Operative Surgery, are yet pre-eminently necessary in that connected with the Eye.

In Mackenzie's learned work, the reader will find accounts of nearly all the operations at different times suggested or practised in this country and abroad.

CHAPTER XVI.

OPERATIONS FOR CATARACT.

THERE are three principal methods of removing an opaque lens from the axis of vision:

1. By thrusting it in such a manner from its natural position that, although left in the eye, it may not prevent the rays of light passing uninterruptedly through the pupil to the retina. This, the earliest of all Cataract Operations, is termed *Depression* or *Couching;* the lens being pressed down into the vitreous humor.

2. By removing the lens bodily out of the eye, through a wound made for that purpose in the cornea;—*Extraction.*

3. By taking advantage of the peculiar facility with which Nature, under certain conditions, dissolves and absorbs the entire substance of the lens;—the Operation for *Solution* or *Absorption:* termed also, from the modes of performing it, *Division* and *Discission.*

OPERATIONS OF DISPLACEMENT.

DEPRESSION. RECLINATION.*

Before the earlier part of the eighteenth century, while Cataract was supposed to be an opaque

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*** The terms Keratonyxis and Scleronyxis, applied to needle operations, merely designate the structures—cornea or sclerotic—through which the instrument is passed.**

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membrane in front of the lens, surgeons were quite consistent in practising *Depression;* for such a membrane, when once pushed fairly away from the pupil, would not be likely to set up irritation. And when the real nature of Cataract came to be known, operators readily persuaded themselves that even so bulky a body as the lens could, by skilful manipulation, be so placed that it should not press upon, or interfere with, any of the delicate tissues surrounding it.

To pass a needle through the sclerotic or cornea, until its point arrives at the upper edge or the front surface of the opaque lens, which is then pressed downwards, or backwards and downwards, and imbedded in the vitreous humor—appears a real triumph of surgery; so instantaneous is the benefit conferred by the operation, and so trifling the pain of its performance. The patient is in a moment restored to sight; and the minuteness of the wound seems to obviate all risk of after-inflammation.

And, doubtless, *Depression*—or the modification of it termed *Reclination*—would be a very perfect operation, if one could insure the Cataract being conducted to the position so neatly depicted in diagrams, where it reposes in the vitreous humor, quite out of the way of the pupil, and close to, but never touching, the retina or the ciliary processes. But how is the Cataract to be so placed *in reality?* Even if the sclerotic were as transparent as the cornea—so that the surgeon could watch the point of his needle throughout every stage of the operation—how could he deposit the lens precisely in the position I have alluded to? Or, if he succeeded in leaving it just in the very spot he had intended—below the pupil and yet above the retina—how could he insure its remaining there? And if it sank downwards, so as to come into contact with the retina, or rolled forwards against the ciliary processes and iris, would it not act as a foreign body, and set up irritation, which would be almost wholly beyond control?

The various mishaps that attend the operation of *Extraction* are evident to every bystander; but, in *Depression*, provided the Cataract disappears from the pupil, all seems to have gone well. The mischief that may have been inflicted on deep-seated structures cannot be detected; and it is only in the course of weeks, or months, that a train of symptoms sets in which, long after the operation, may terminate in utter loss of sight.

No doubt cases occur in which *Depression* perfectly succeeds; but I would most earnestly warn the student, who may have been struck with the showiness and apparent ease of the operation, against supposing that it is a sort of safe substitute for the perils of *Extraction*.

The true test of the two operations is this: "What, at the end of a year, will be the condition of patients who have undergone the one or the other form of operation?" "Who will have the better sight *then?*"

The Operation.—"Depression," properly so called, consisted in thrusting the lens directly downwards; but it is evident that a body so bulky could hardly be made to descend vertically below the level of the pupil, without endangering the retina. It was, therefore, recommended to press the lens in a direction downwards, backwards, and outwards, so that it should *recline* with its anterior face directed upwards. This modification of the ancient operation is termed *Reclination;* and it has, in its turn, been altered in various ways.

The patient is usually seated, and the surgeon sits facing him. An assistant, standing behind the patient, steadies his head, and raises the upper lid with a wire elevator. A needle, either straight or curved at the point, according to the fancy of the operator, is thrust through the sclerotic, at a short distance from the outer margin of the cornea, and a little below its equator. When the point has fairly entered the cavity of the eye, it is carried on behind the iris, until it becomes visible in the area of the pupil, which has been previously dilated with atropine. The needle is then steadily pressed against the lens a little above its centre, so as to force it to quit its natural situation, and to sink down into the vitreous humor, until it assumes the position I have mentioned; namely, with its anterior surface directed upwards, its posterior surface downwards—near to, but not touching the retina—and its lower edge also towards, but not in contact with, the ciliary processes; a state of things, I fancy, much more frequently to be seen in diagrams than in practice.

From the relative position of the iris and lens, it seems all but, if not quite, impossible to pass a needle between them without wounding either one or the other; and in carrying the instrument across the pupil, the capsule is almost always opened, and usually a still more extensive rupture takes place in the attempts to displace the lens. No doubt this breaking up of its tissue contributes very much to the success of the operation, which becomes in that way a mixed one of "Displacement" and "Solution." If, in consequence of old disease, the suspensory ligament of the lens has been loosened, the entire Cataract, inclosed in its capsule, may possibly sink at the first touch of the needle; especially if the vitreous body have undergone a change in respect of increased fluidity.

But if the hyaloid membrane and vitreous body be strong and healthy, they may offer great resistance to the reclination of the lens; and various plans have been suggested for preparing both structures, by some preliminary manœuvres, for their changes of situation. By some it has been proposed to carry the needle, as soon as it has pierced the coats of the eyeball, to the back of the lens, for the purpose of lacerating the posterior capsule; then to lacerate the anterior capsule, and not until after this to attempt the displacement of the lens itself. Others, finding that the elastic vitreous body resists the passage of the lens through it, pass the needle to the spot where it is intended that the lens should be lodged, and there prepare a bed for it, by breaking up the cells of the vitreous body. These manipulations are more easily described than performed. When the point of an instrument is "out of sight," it is apt to be "out of mind;" and especially, in the attempt to prepare a soft place in the vitreous for the lens to lie in, there must be the utmost risk of scratching up with the needle the ciliary processes, and the retina itself.

The difficulty of displacing the lens by mere pressure, has induced some operators to advise *transfixing* it with the needle, which is to be disengaged by giving it a rotatory motion, after the lens has been deposited in the appointed spot. The danger of injuring surrounding structures seems to attend this plan to even a greater extent than attends the others I have mentioned.

Of late years operations of displacement have been so generally abandoned, that I may be thought to have unnecessarily wasted words in their condemnation. There is, however, a tendency from time to time to revert to surgical procedures which have been abandoned, and I have therefore allowed the foregoing pages to remain as they appeared in the last edition of my volume.

THE OPERATION BY SOLUTION OR ABSORPTION.

Of this operation there is a form, until lately much practised on the Continent, known as "Discission," because the lens is said to be cut up into several small portions. Little knives even have been invented for effecting the complete division of the lens. Such a violent proceeding, however, if it could be accomplished, would be quite improper, and opposed to the true principle of the cure by Absorption, which is essentially a slow and gradual one. If from a recently dead subject we take a lens, and, holding it steadily in one hand, try to cut it through with a sharp knife, we shall be able to appreciate the extreme difficulty of making a similar division of a Cataract in the living eye. For the lens is maintained in its natural position by very delicate tissues, little capable of offering resistance to a cutting instrument; while it is at the same time surrounded by structures which are sure to take on inflammation, if rudely pressed upon or contused.

The true operation of Solution or Absorption is, perhaps, the most beautiful and perfect in the whole practice of surgery. It is based, as I have already observed, on the principle that, if the capsule be lacerated so as to expose the tissue of the lens itself to the macerating action of the aqueous humor, the cells and fibres of the lens gradually imbibe the fluid, become broken up and dissolved, and are then absorbed so completely that, at the end of a period varying according to the consistence of the part and the age and vigor of the patient, every vestige of lens has disappeared. The capsule, on the contrary, never undergoes absorption. When divided, it shrinks, rolls upon itself, and retracts, so as to leave large spaces vacant which it had previously occupied, and thus an appearance of its absorption is produced; but these points of marked difference between the two structures must never be forgotten during the consideration of Cataract, and the operation for its cure.

I have said that the rapidity with which the lens undergoes absorption depends upon its consistence, and upon the age of the patient. In fact, provided the constitution be vigorous, it is quite possible to effect the absorption of a Cataract in an old person, even up to the age of seventy. But, inasmuch as Cataract usually exists in both eyes in such persons, the slow process of absorption is found to be wearisome and inconvenient, and liable to be interrupted by inflammatory attacks; and as the operation requires to be frequently repeated, the more rapid one by Extraction is greatly to be preferred.

The operation by Solution is to be invariably chosen for infants and children; it is also suited for adults with Cataract in one eye only, who can, therefore, without inconvenience, await the slow result of the operation. To patients with whom the after appearance of the eye is of importance, the preservation of the original form of the pupil is one great advantage of this method.

Position of the Patient.—During the operations of Solution, as of Extraction and Artificial Pupil, he should lie upon a couch, so arranged that the head may be very little raised above the level of the body. Infants and unruly children must be securely swathed from the chin to the feet, with a round towel or folded sheet; or they must be brought under the influence of chloroform. The surgeon either sits or stands behind the patient, and controls the movements of the lids with a spring speculum.

The needle is passed through the cornea, near its outer margin, and carried onwards until the point reaches the middle of the pupil, which has been previously dilated with atropine. Then the capsule is punctured near its centre, care being taken not to thrust the instrument deeply into the lens, for fear of dislocating it from its position. The opening in the capsule is then enlarged to about the extent of an undilated pupil; the working of the needle being at first confined to the superficial layers of the lens at the centre of the pupil, and gradually extended from that point towards the circumference. If two needles are used together, the second is not to be passed through the cornea until the point of that which was first introduced has reached the middle of the pupillary space.

In the congenital Cataracts of infants, very free use may be made of the needle, as regards the breaking up of the tissue of the lens. I have even seen the entire lens shell out of its capsule, and fall into the anterior chamber, without any bad consequences resulting; the lens becoming very rapidly absorbed, and not requiring a second operation, except perhaps for the division of some portion of capsule. Such an accident in an adult, especially in an elderly person with a firm lens, might require its speedy extraction, as the only means of warding off the onset of a destructive inflammation.

It is impossible to lay down any precise rule as to how often, and at what intervals, these needle operations ought to be repeated. A single operation may, as I have just said, suffice for the complete absorption of the lens; while, in an elderly person, the needle may be reapplied to it every six weeks or two months; and even then, a year or more may elapse before a perfectly clear aperture through the centre of the Cataract is obtained; and if attacks of inflammation occur to interrupt the absorbing process, even longer intervals must be allowed. For while, in a young subject, the lens rapidly imbibes the aqueous fluid, and becomes pulpy and flocculent throughout, a much slower change takes place in old lenses; only just that quantity which is crumbled off at each operation seems to be absorbed, and then no appreciable advance is made until a fresh portion of the dense tissue is dug out with the needle.

It is a besetting error of inexperienced operators to suppose that the cure will be hastened in proportion to the amount of lens they can break up at one time; but, except with young subjects, the very reverse is the case. The great rule to be observed is,—not to *oppress* the eye with more broken-up tissue than the absorbing power of the organ is capable of removing rapidly; otherwise, the little fragments act as foreign bodies; inflammation is set up, and all absorption is at once checked; the sclerotic and conjunctiva become injected; there is pain in and around the eye, with weeping, and considerable intolerance of light; the aqueous humor is turbid, and the iris discolored; the cornea appears hazy, and its epithelial surface looks like a steamed glass.

In such a case, the eye may be lost by chronic inflammation, unless it be forthwith relieved from the broken-up lens which is oppressing it. This may be done by making an incision near the margin of the cornea, and introducing a small scoop or *spatula*, so as to allow the softened portions of lens to escape with the aqueous humor. An operation of this kind, if resorted to in time, may restore the whole eye to a healthy condition; the inflammatory symptoms rapidly subsiding, and the iris and cornea resuming their natural aspect.

This evacuation of the whole mass of broken-up lens may be necessary soon after the first operation, if the needle has been too freely used on that occasion; or it may be required at a later stage of the case, in consequence of the tissue of the lens rapidly imbibing the aqueous humor, and thus swelling up so as to acquire a great increase of volume.

There is one form of Cataract—the *fluid* form—which always requires something more than a simple laceration of the capsule; for retention of the milky fluid within the anterior chamber produces peculiarly distressing nausea and vomiting, attended with neuralgia.

If, when the capsule is first punctured with the needle, a jet of milky fluid bursts forth, and mixes with the aqueous humor, so as totally, or in part, to conceal the iris, the cataract needle should be gently withdrawn, and a broad cutting needle, such as is used for opening the cornea in making an artificial pupil, should be at once passed in at the same spot; and, by turning it on its axis, the whole of the fluid may be evacuated. The vomiting, which often ensues when only a small portion of the lens beginning to undergo the *fluid* change passes into the anterior chamber, is the more remarkable, as it is rarely caused by the dislocation of a *firm* lens into that cavity; although the latter accident may set up inflammation, and cause the most intense pain. Neither does vomiting occur in young children after the ordinary operation for Congenital Cataract, even when a considerable escape of milky fluid follows the puncture of the capsule. Anxiety to get rid of the entire mass of a cataractous lens at once, rather than await the slower process of natural form a mere ring, concealed when the iris is in its natural condition, and only becoming visible when the pupil has been artificially dilated; but more commonly it also stretches across the central portion of the pupillary space.

There are no manipulations which require more judgment and care than those for removing such filmy obstructions. The two chief points to be observed are,—to make the aperture in the capsule central, so that it may correspond to the axis of vision; and to avoid isolating any portions by detaching them from the rest of the membrane. Loose shreds of this kind, when set floating by careless management, are ever afterwards a source of annoyance both to the patient and to the surgeon. Lastly,—the division of the capsule is to be made with the least possible disturbance of the vitreous body behind it.

Every movement of the needle should have some definite object. It is useless to make stabs and plunges at portions of detached capsule, in the hope of *depressing* them by some lucky hit; for their buoyancy will almost always cause them to return to their former position, as soon as the needle is withdrawn. Delicate bands, stretched tightly across the pupil, may be divided in the middle, and then each half will retract towards its fixed point, and leave the area free.

When a single needle is employed to tear through a portion of capsule, it sometimes happens that the delicate membrane yields and stretches, instead of tearing, and, after each attempt, the surgeon is mortified at seeing it return to its former situation. It is in such cases that it is so efficacious to use two needles at once, as suggested by Mr. BOWMAN.* There is hardly any filmy expansion, or hair-like band, that may not, by this expedient, be divided.

The lids being held apart with a spring speculum, the surgeon has both hands at liberty, and he separately introduces the needle through the cornea, until their points reach the area of the pupil. He then, according to the nature of the obstruction, either makes in the centre of the membrane a small hole, and then enlarges it, by drawing the points of the needles in opposite directions—or cuts, twists, or tears through some band or filament which had been holding together the margins of the pupil, and obstructing its area.

The young operator, who may feel inclined to underrate the difficulty of skilfully using two needles at once, ought to be warned that it requires much previous practice on the dead subject to acquire the power of keeping the attention properly fixed on both instruments; and in the living subject the difficulty is greatly increased by the movements of the eye. Unless great care be taken, the needles may be sunk too deeply into the vitreous body, or thrust against the iris, or allowed, during some sudden roll of the eye, to slip out of it altogether, before the object of the operator has been attained. These accidents may be obviated by having the eye steadied by an assistant, who, with a broad-ended forceps, nips up a fold of the ocular conjunctiva.

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* Medico-Chirurgical Transactions, 1853, vol. xxxvi, p. 315.

If the rules which I have said should guide the surgeon in effecting the absorption of a lens be strictly adhered to, namely, to attack a Cataract at the centre, and always to work the needle steadily from that point towards the circumference; and to be satisfied with slow progress, without attempting to break up a large mass of lens at the earlier operations: and if, in like manner, he carefully avoids isolating and setting loose any portions of capsule, he will rarely find it necessary to employ any other instrument than needles, for obtaining a perfectly clear and useful pupil.

But if a case has already been unskilfully operated on, and the needle used roughly, and without any determined or settled aim, it may happen that the entire capsule, containing some small remains of white lens-matter, has become crumpled up, and rolled into an opaque mass, which is either held fast in the midst of the pupillary space by two or three delicate bands, or is attached by a solitary filament, which allows it to float and sway to and fro with every movement of the eye. In such a case, the entire mass of capsule must be drawn out of the eye. To effect this, an incision of suitable size is to be made in the cornea, near its edge, and a cannula forceps introduced, the points being kept closed until they have reached the capsule. They are then opened; the capsule is seized, and withdrawn by gentle traction, sufficient to make the retaining filaments give way.

When tough, opaque capsule is retained in the pupil by firm and broad attachments, reaching out of sight behind the iris, the cannula forceps or any similar instrument, must be used with great caution. For want of this, the ciliary processes and neighboring parts are sometimes dragged, and in consequence the most serious deep-seated inflammation may set in.

OPERATIONS OF EXTRACTION.

The absorption of an opaque lens in an old person is so slow a process—in consequence both of the peculiar structural change in the nucleus of the Cataract itself, and the diminished rapidity with which interchange of material goes on in advanced life—that a more rapid removal of the opaque body becomes desirable. While, therefore, special circumstances may induce the surgeon to use the needle on patients beyond fifty, or even sixty years of age, he will, with the majority of them, find it advisable to employ *Extraction.* A few years ago this term had but one signification, namely, the removal of the lens through a crescentic flap-wound of the cornea. Lately, however, an operation, first practised by GIBSON, has been reintroduced, with certain modifications, under the name of "Linear Extraction;" and still more recently GRÆFE has devised an entirely new procedure, in which Iridectomy is performed as a preliminary to removing the lens by means of a scoop.

We may distinguish these three forms of operation as *Flap Extraction*, *Rectilinear Extraction*, and *Scoop Extraction.**

FLAP EXTRACTION.

The leading points to be observed in *Flap Extraction* are,—

To make a crescentic incision through the cornea, sufficiently large to afford an easy exit to the lens:

To take care that the line of incision shall be at such a distance from the sclerotic as to insure both edges of the wound being of genuine corneal tissue; for wounds of the true cornea, provided their edges are in accurate apposition, have a peculiar readiness for uniting, which is not equally shared by that extreme marginal portion which blends with the sclerotic:

To lacerate the anterior capsule freely, so as to allow of the lens readily escaping through the rent when pressure is made on the globe:

To apply this pressure in such a way that the lens may slowly turn on its transverse axis, and present its upper margin, first at the pupil, and then at the corneal wound.

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* These terms, it will be seen, are not formed on one uniform principle of nomenclature. By the first two the direction of the corneal incision is indicated; by the third term the instrument with which the lens is extracted. But I cannot suggest any better names. They are well distinguished from each other as to sound, and cannot possibly be confounded together. "Rectilinear" is certainly more correct than "Linear." The latter term might as fitly be applied to the wound made in a flap extraction, for that, too, forms a line, although a curved one,

When we consider that the object is to dislodge and press out the lens, and at the same time to avoid pressing out any portion of the vitreous body, it must be evident that extreme care and delicacy of handling are necessary. The surgeon must regulate his pressure with a nicety which is hardly possible unless he has the globe under his sole management. The best *position for the patient*, therefore, is to lie upon a high couch, with his head alone slightly raised; and the surgeon, sitting or standing behind him, can then control the movements both of the upper lid and of the globe. Formerly, the patient was always seated on a chair, the surgeon sitting opposite to him. In such a mode of operating, the patient's head rests against the breast of an assistant, who stands behind him, and at the same time has charge of the upper lid. But in this way it is impossible for the patient's head to be kept as immovable as when resting by its own weight on a firm cushion; nor can a second person, however careful, be trusted to control, by gentle pressure, the movements of the patient's eye. What anatomist, about to commence a minute dissection, would allow the preparation to be held in the hands of an assistant, instead of placing it on a table?

The difficulty in making the section of the cornea in the Operation of Extraction, arises from the fact that the knife has to be carried across a cavity (the anterior chamber) filled with a fluid ready to spirt out at the smallest opening which the blade of the instrument may leave unguarded. The moment such an escape of fluid takes place, the pressure of the elastic contents of the globe forces the iris forwards over the edge of the knife.

The sawing motion of a common knife is therefore unsuited for making the corneal section, inasmuch as each to-and-fro movement of the blade would permit a fresh escape of aqueous humor, or inflict a wound on the iris when that structure had come forward to fill up the place of the lost fluid.

Hence arises the necessity for having a blade which regularly increases in width and thickness from the point to the heel. Such an instrument, if steadily carried on in one direction, completes the wound at a single thrust, while its wedged shape prevents the aqueous humor escaping too soon, and thus lessens the danger of wounding the iris.

It would be very unprofitable to enter here into a description of the various Cataract knives which have, at different times, been invented. One operator after another has endeavored, by alterations in the shape of the blade, to overcome the special difficulty which has most beset him; but ophthalmic surgeons are now pretty generally agreed that the knife which goes by the name of BEER's knife, is, with certain modifications, the most useful, and that no mechanical contrivance can obviate all the difficulties attending the Operation of Extraction.

Having raised the upper lid, by placing his fingers against the edge of the tarsus, the surgeon confides the lower lid to an assistant, who draws it downwards, and keeps it fixed by making pressure against the malar bone. This he must take especial care to do, and not in the slightest degree to press upon the eyeball. The surgeon may control the movements of the eye by lightly placing the tip of one finger against the sclerotic, just above the cornea, while the other rests against the inner side of the globe. To do this safely, requires the greatest tact and care, for as soon as the knife has transfixed both sides of the cornea all pressure must cease, and it must at no time be greater than will just suffice to enable the operator to make his puncture and counter-puncture with certainty. Firm pressure, kept up until the section is completed, will almost inevitably cause the lens to be violently ejected with a gush of vitreous humor. When an eye is very irritable and unsteady, it may be fixed by an assistant, who, with a broad-ended forceps, nips up a fold of the ocular conjunctiva below the cornea. He must, however, be especially careful not to press on the globe itself. Or the lids may be left to the assistant while the operator himself uses the forceps.

The surgeon introduces the point of his knife on the equator of the cornea, a short distance in front of its junction with the sclerotic, and carrying it steadily across the anterior chamber, brings it out again at the corresponding spot near the inner margin of the cornea. In making this thrust, the edge is directed towards the upper margin of the cornea, so that, when the section is completed, a semilunar flap is formed.

This upper section has been found to possess so many advantages, that the lower one is now scarcely ever employed.

It must be the surgeon's chief object to give the knife a steady onward pressure, so that the blade may constantly fill up the wound it is making. If he in the least withdraws the knife, or rotates it on its axis; or if he attempts too soon to cut out, instead of completing his thrust, a jet of aqueous humor takes place at that portion of the wound which is no longer filled by the blade, and the iris instantly folds over the edge; one of the most troublesome occurrences which can attend the operation. Every care, however, on the part of the surgeon will not always suffice to prevent this loss of aqueous humor; for so ready is the fluid to escape, that, if the sides of the knife be unevenly ground, sufficient space may exist between the blade and the edges of the wound to allow of the fluid finding its way out.

When the iris has fairly come over the knife, the surgeon may sometimes disengage it by laying his finger on the front of the cornea, and making pressure in such a direction as may cause the iris to slip back again behind the edge of the instrument. Careful pressure on the cornea must then be kept up until the knife has been fairly carried through it, and until the section is almost completed.

But the operator may find it impossible wholly to disengage the iris from the knife, and a portion of the upper margin of the pupil may be cut away. This of course causes a slight bleeding into the anterior chamber, which obscures a view of the parts during the after stages of the operation; but the lens usually escapes readily through the artificially enlarged pupil, and, except the after deformity, no permanent bad result necessarily follows the accident. It sometimes happens, however, that a *fold* of the iris is cut through; the consequence of which is that there is a hole through the iris just above the true pupil. When this occurs, the surgeon must divide the band of iris between the two apertures, so as to lay them into one, before proceeding to lacerate the capsule, and attempt the extraction of the lens.

Those who have seen little of eye operations are apt to imagine that the section of the cornea, if well made, must needs be a quick and showy performance. The very reverse of this is commonly the case; and while a careless, off-hand operator may complete the corneal flap at a single rapid plunge, bringing out the knife he hardly knows where, and, perhaps, at the same moment, squeezing out the entire lens with more or less vitreous humor; the painstaking and really skilful surgeon may dwell upon the section, and seem to be over-slow in completing it, whereas the sole cause of delay has been a well-founded desire to prevent the too sudden escape of the contents of the globe.

As soon as the corneal flap has been completed, *the upper* lid is allowed gently to fall, and the surgeon proceeds to the second stage of the operation—the division of the anterior capsule.

After a short pause, he very carefully raises the upper lid again, and surveys the wound. If he finds it too small, he must enlarge it by passing a little, narrow, blunt-ended knife, or curved scissors, under the flap, to the outer angle of the wound, and carefully dividing the cornea close along its margin in a downward direction.

This enlargement of the original wound is often very difficult, on account of the slight resistance offered by the loose flap of cornea, and the irritability of the eye, which the surgeon dares not attempt to control by pressure. No difficulty, however, should deter him from making the wound sufficiently large before he attempts to press out the lens. For if, while the opening in the cornea is too small to allow of the lens easily passing through it, pressure be made on the globe, the hyaloid membrane will most probably give way, and a portion of the vitreous humor will escape; whereupon the lens, instead of presenting at the section, sinks down into the space left by the lost fluid. When this accident occurs, the surgeon must at once desist from all pressure on the globe, and pass in a scoop, through the gaping wound and pupil, to the hinder surface of the lens, which must be drawn out as quickly and lightly as possible.

When it has been ascertained that the wound is of proper size, the curved needle (termed the *Cystitome*) is slipped under the corneal flap, care being taken not to entangle it in the iris; and when its curve is fairly in the pupil, the handle is rotated, so as to turn the point against the capsule of the lens. Some writers give very precise directions as to the manner in which the capsule is to be divided—one recommending a crucial incision, while a second tells us to make a series of cuts crossing each other at right angles, so that the lines of incision may include a number of lozenge-shaped interspaces—instructions, I fancy, rather difficult to follow, even if the eye were not a living and moving one; but very unlikely to be executed upon a patient in the same regular manner as they are figured in the author's diagram.

In tearing through the capsule, the surgeon must take care that the rent extends quite across the area of the pupil; and, provided this laceration is sufficiently ample, he need not trouble himself about unattainable niceties of incision. This part of the operation requires a careful eye and a light hand, otherwise the lens itself may be displaced and the capsule left unbroken.

The needle having been withdrawn, the lid is again allowed to fall, and the surgeon prepares for the third stage of the operation—the removal of the lens.

It is a fatal error to suppose that this is to be accomplished by main force; that the eye may be squeezed, no matter in what direction, if it be but squeezed hard enough. The real object of the pressure is to make the lens first turn on its transverse axis, so that its upper edge may be presented a little forwards. To accomplish this, the concavity of the scoop (*curette*) is laid against the sclerotic, a little below the inferior margin of the cornea; and while moderate pressure is made at this spot, the point of the fore-finger of the other hand is placed on the upper part of the globe, a little above the section; then, by a carefully regulated alternating pressure in these two situations, the lens is made slowly to turn, and to present its upper edge at the pupil. The lens continues to advance through the pupil, and then begins to protrude at the corneal wound. It is evident that, as soon as the greatest diameter of the lens has passed through this aperture, the rest will be inclined rapidly to follow; and therefore, if the surgeon does not very carefully moderate his pressure, the lens will suddenly start out, and very probably be followed by a gush of vitreous humor. According to the size of the corneal wound and the degree of superficial softening which may have taken place in the Cataract, will be the amount of soft matter the lens will leave behind, in passing out of the eye. A small lens will escape almost entire through a large wound; while, if the wound be small, and the lens bulky and much softened on the surface, a considerable quantity of lens-matter will remain in the pupil and about the lips of the wound. If undue violence be employed, the lens, still inclosed in its capsule, may, as I have said, be suddenly shot out on the patient's cheek, with a large portion of vitreous humor.

Inasmuch as union of the corneal wound—upon the rapidity of which so much of the success of the operation depends—cannot take place if any foreign matter be allowed to remain between its margins, all soft lens-matter which may have stuck there must be removed with the scoop (*curette*). The iris, which very frequently protrudes, can be best returned to its position by means of the small *spatula*. It is unsafe to dip too much into the pupil with the scoop for the purpose of removing every vestige of the Cataract. The capsule cannot be removed by such means, and a free use of the instrument is very likely to rupture the hyaloid membrane, and cause a loss of vitreous humor. Provided the lips of the corneal wound are in perfect apposition, and the iris is in its proper place (which may be known by the position of the pupil), the capsule, and small portions of lens-matter entangled in it, may safely be left for future removal, after the wound is healed and all irritation gone by.

If there has been a gush of vitreous humor at the moment the lens passed out, the lids must be instantly closed, and a short pause allowed before any attempt is made to see what has become of the corneal flap. Any prolonged examination or full exposure of the eye in these cases, can only lead to fresh escape of vitreous humor. The surgeon, therefore, must content himself with gently raising the upper lid by the eyelashes, sufficiently to allow of his ascertaining whether the flap has been doubled down, as is frequently the case. If he is sure this displacement has not occurred, he must be satisfied, and not wait, in the vain hope that the wound will close; for the constant tendency of more and more vitreous humor to escape will render any close adjustment of the flap impossible. He must at once close the eyelids, and apply the bandages or plaster.

However favorably cases of this kind may terminate, there always remains a deformity of the pupil. The aperture is large, and drawn up to the wound; and the upper portion of the iris (when the upward section has been made) seems to be altogether lost.

The most unfortunate accident that can attend the operation of Extraction—for it instantly destroys all hope of sight—is *Hemorrhage into the vitreous chamber.*

It now and then happens that—although the corneal section may have been perfectly well made, and every due precaution taken—a gush of vitreous humor (or of watery fluid which has in part replaced it) occurs at the moment the lens escapes through the wound. Within the space of a minute or two the patient complains of severe pain in the eye, and blood soon appears oozing from between the lids. This oozing does not occur until the whole cavity of the eyeball has become filled with blood, and the eye for ever destroyed as an organ of vision. In some instances the hemorrhage sets in later—several hours, perhaps, after the operation.

In all these cases we must assume the existence of some diseased condition of the deep-seated tissues: either old effusion between the choroid and retina, or a change of structure in the choroidal vessels themselves.

Such, very probably, is the cause of a similar hemorrhage which often follows the removal of staphylomatous projections of the globe, which have been attended with long-continued inflammation. As soon as the more prominent portion of the Staphyloma has been cut away, the pent-up aqueous humor and serum, and, perhaps, the diffluent vitreous body, rush out through the wound; and this sudden removal of pressure from the enlarged choroidal vessels causes them to give way. In two cases of this kind, I found the whole retina enveloping the large clot which had been forced out of the eyeball; a proof that the hemorrhage which had detached the retina must have had its source behind that structure.

THE AFTER-TREATMENT OF CASES OF FLAP EXTRACTION.

This is a subject so extensive, that I should far exceed the limits I have proposed to myself were I to devote to it as much space as its importance deserves. A few remarks, however, appear absolutely necessary.

The prevalent belief—that *all* operations for Cataract are likely to be followed by "Inflammation" —is, of course, unqualified in the popular mind by any definite notion as to what is the nature of this "Inflammation;" why it arises, or what parts of the eye it involves; and many of those who are commencing the study of eye diseases, have equally vague notions on the subject. Let us, then, examine a little into what takes place in an eye after Extraction has been completed. We will suppose that the structure of the organ, with the exception of the lens, was in a healthy condition, and that the operation has been properly performed. What has been done?

A clean cut has been made through rather less than half the circumference of the cornea; the lens has been gently squeezed through the pupil and the wound; the aqueous fluid has escaped; the iris is in contact with the hinder surface of the cornea, the cut edges of which are in exact apposition; the upper lid lies smoothly against the wound, and keeps all steady.

Within a few hours, provided the nutrition of the patient's body be in a healthy state, adhesion takes place between the cut edges of the cornea. As this union becomes firm, the aqueous humor is retained; it once more fills the space between the cornea and iris, and defends the latter from the pressure of the parts behind. The slight irritation to which the iris had been subjected by the passage of the lens through the pupil, passes off; and in a longer or shorter time, according to the constitution of the patient, the extra quantity of blood, which had been carrying reparative material to the wound, ceases to be sent thither; and the cure is complete.

This is just what happens in *accidental* cuts of the cornea. If the patient be at the time in a good state of health; the cut a clean one, and unattended with contusion; no iris or other substance interposed between its edges; and if the eye be carefully kept at rest, and secluded from the action of light and other irritants, the wound heals in a few days, just as if it had been inflicted *secundum artem.* But let a similar accident befall an old, feeble person, or one reduced to feebleness by want, or inflamed by intemperance—and let the first two patients be bled, and put on low diet, while the third continues his indulgence in alcohol—what will *then* be the result? Non-union of the wound; total or partial slough of the cornea, and a series of morbid changes in the adjacent tissues; in short, loss of the eye as far as sight is concerned.

Now let us apply these facts to a case of Extraction, treated as all such operations were treated thirty or forty years ago, and as certain works of established reputation advise us to treat them in the event of pain being felt in the eye soon after the operation.

If the operative proceedings have been properly conducted, and all has gone well, in the manner above described, Nature knows how to heal the wound. She will not send thither more blood than is needed; and when the work is completed, the extra supply will cease. If, on the other hand, the iris has been forced into the wound, there is at once a mechanical hindrance to its quick union, and we must wait until, by a slower process, the effused lymph has agglutinated the iris to the separated edges of the cornea. If vitreous humor has been lost, the corneal wound may gape, instead of falling together, and its lips are kept asunder by the remaining vitreous body which is attempting to escape.

Now, what can *bleeding* do in such cases? Can it dislodge the iris from between the lips of the wound? or can it prevent the vitreous body from bulging where it meets with least resistance? We might just as well expect, by copious bleeding, to dislodge a piece of muscle that was lying between the ends of a fractured bone, and preventing their union.

Extraction of Cataract is an operation performed on those who are past the middle period of life. No doubt, among such persons several are to be found who are plethoric, too much filled with blood, over-fed, over-stimulated with alcohol. They require to be "toned down," and brought into a more healthy state by a well-regulated plan of diet, for some time *before* an operation is begun, not bled just *after* it is ended, and thus put into an unatural condition at such a critical period.

But, independently of *prolapsus iridis*, non-union of the corneal wound results from the same cause which prevents the union of a flesh wound, or of a broken bone—namely, the depression of the patient's nutritive functions below the proper standard of vigor. To keep an old or feeble person upon "slops" for several days after Extraction—for fear inflammation should set in—is surely contrary to common sense, and to all analogy in sound surgical practice.

Yet a great authority in Eye-surgery, less than forty years ago, could give such advice as the following: that, within a few hours after the operation of Extraction, a quantity of blood should *always be abstracted, whether pain come on or not;* that, "from four to eight hours after the operation, unless pain has come on sooner, blood is again to be drawn from a large orifice;" and yet again, "if pain should come on afterwards, or continue:" and that, for the first five days after the operation —while the patient is being drained of blood in this manner—his diet is to consist of "nothing but gruel, tea, arrow-root, and panada."* One need not be a surgeon to foresee the probable condition of a wound under such discipline as this. If a patient be thus weakened, pain of a neuralgic character is sure to come on, and each successive drain will be followed by a fresh attack.

Having occupied so much space in explaining what the after-treatment of Extraction cases ought *not* to be, I can devote comparatively little space to the consideration of the treatment they really demand; for so much depends upon the constitutional peculiarities of the patient, and the minute varieties of appearance which the wounded parts may present, that to do full justice to the subject would require the publication of a large number of cases, with much detail respecting the events of the operation.

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* Guthrie; Lectures on the Operative Surgery of the Eye. Second edition, 1827, p. 347.

The following is, therefore, but an outline of what ought to be done. As soon as the surgeon has satisfied himself that the wounded parts are in a proper position, he allows the lids to be gently closed, without permitting any such trials of sight as may safely be made after removal of opaque capsule, or the formation of an artificial pupil. When the media of the eye have just been disturbed, and the pupil is still incumbered with shreds of capsule, and perhaps minute fragments of lens, objects must necessarily appear to the patient in a state of distortion and confusion, by no means likely to inspire him with hopes of ultimate recovery. The assurance of the surgeon, that all has gone well, and that to restore good sight, time and patience only are wanted, will go much further towards tranquillizing the patient's mind than any premature experiments.

Both eyes are then covered with blinkers of folded linen, which are kept in place by a roller passing round the head. An excellent bandage has lately been introduced by LIEBREICH, which keeps its place admirably, and can be instantly fastened and unfastened, without the patient's head being moved. A little pile of cotton-wool laid over the blinkers before the bandage is applied, gives a gentle amount of support to the eyes.

After the operation, it is well for the patient to remain quietly on the couch for some hours. When in bed, the best position for him is to lie on the back, but this is by no means to be insisted on, if it becomes irksome. That position is really the best which is most comfortable, and likely to induce sleep.

As regards diet, patients should not be deterred from taking a nutritious meal a suitable time before the operation is performed; and a moderate quantity of easily digested animal food should be given on each following day. Old and feeble persons will require to have meat finely minced, or some other nourishing form of animal food, in moderate quantities, and at proper intervals, on the very day of the operation. In respect of stimulants, it is impossible to lay down any absolute rule. Those habitually accustomed to take wine, beer, or spirits, must by no means be wholly debarred from them at a time when the nutritive powers of the body are called upon to form new material for rapidly repairing a breach of surface. In short, the surgeon's object must be carefully to regulate both food and stimulants according to the patient's previous habits; neither keeping him too high nor too low, but as near as possible up to the ordinary level of healthy vigor.

A narcotic is sometimes needed on the first night, and in some restless persons, especially those accustomed to opiates, the dose may require repetition; but these cases form the exception, not the rule; loss of appetite and nausea are so apt to follow the use of these drugs, that they should never be given without manifest cause.

Of course the patient is to be thoroughly waited upon during his confinement, so as to be spared every unnecessary movement or exertion; and tapes passed around his wrists from the sides of the bedstead will be a useful check upon sudden movements of the hands during sleep.

The precaution of giving some opening medicine a day or two before the operation, will prevent the necessity for teasing the patient with purgatives during the first few days after it. Old and feeble persons are sometimes seriously prostrated by being purged on the second or third day, when it is so important that the healing process should be steadily advancing.

The daily cleansing of the lids requires caution; the object not being to prevent the eyelashes sticking together, even if that were practicable, for their agglutination forms the best safeguard against the patient's prematurely opening the eye. The lower lid and cheek are to be washed with warm water, but the upper lid must on no account be touched, for under its shelter lies the corneal wound, sudden pressure on which would produce great suffering, and might even cause its slightly-formed adhesions to give way.

The progress of the wound is to be judged of by the condition of the lid and quality of the secretion, and by the patient's feelings. If he complains only of an occasional pricking and a sensation of grit; and if this can apparently be traced to the slight involuntary movements of the eyeball against the lid; if the uneasiness subsides day by day; if the upper lid is free from redness and swelling, and the secretion consist of tears alone, or is mixed with a little of the natural mucus of the conjunctiva, the surgeon may entertain the best hopes of a good union taking place. An increased feeling of grit in the eye, coming on after the lapse of three or four days, would make him suspect that the section had yielded, and that some *prolapsus iridis* had occurred.

The most unfavorable symptom is a bright redness and swelling of the lid, which sometimes appear on the second or third day after the operation, accompanied with a yellow puriform discharge. This state of things is commonly ushered in by a restless night, with headache, and the patient is much depressed, both in body and mind. When the eye is examined, the ocular conjunctiva is found injected, and so œdematous that it overlaps the corneal margin (*chemosis*). The cornea itself is opaque and yellowish throughout, so that perhaps no trace of the iris can be discerned. The wound is gaping, and the iris bulges into it; eventually the whole cornea softens, the flap sloughs, and the eyeball shrinks.

I have now and then seen this hopeless state of the eye come on after an operation which had been perfectly well performed, and when the surgeon had every right to expect a most successful result. In such cases there has probably been some degeneration of tissue in the bloodvessels supplying the globe, and a weak condition of the heart itself.

After the operation, the number of days that should be allowed to elapse before the eye is examined may vary according to circumstances. If the patient be healthy, and there has been no pain in the eye, or other bad symptoms, the wound will often be found, even on the third day after the operation, perfectly united. In aged or feeble persons, the fourth day is quite soon enough for an examination; and whenever there has been any loss of vitreous humor, so that the process of healing has been retarded, the fifth will be the earliest day on which the eye can be prudently exposed. Indeed, a wound which, on the fourth day after the operation, is going on perfectly well, will be all the better for another day or two of rest, while it often happens that a premature exposure sets up irritation, and, if the union be not firm, favors the subsequent yielding of the wound, and prolapse of the iris.

Should the redness of the lids, attended with puriform discharge, come on in the way I have described within the first two or three days, the surgeon should examine the eye just so far as to obtain a view of the lower part of the cornea, and ascertain whether it is becoming infiltrated with pus, which may be done without exposing the wound itself.

An eye examined on the fourth or fifth day may present any of the following appearances, with various modifications:

1. The cornea may be clear, with the exception of a little hazy line along the edge of the wound; the aqueous humor may be re-secreted, and the plane of the iris vertical; the pupil may either be clear, or filled with a flocculent mass of capsule and lens-matter, accordingly as the lens has come out clean, or has rubbed off its softer cortical substance in its passage; vision may extend to the recognition of large objects, such as the fingers of a hand; or, in consequence of the obstruction still remaining in the pupil, may be limited to mere perception of direct and reflected light. Some little redness of the sclerotic and conjunctiva will, of course, be present in every case, however favorable the healing process may have gone on; but the condition I have just described may be regarded as most satisfactory and encouraging.

2. The appearances may be similar to those above noticed, with the exception of the iris being in contact with the hinder surface of the cornea. This arises from one or other of the following causes: either the wound, although sufficiently united to keep the cornea in perfect position, may not have become so consolidated as to be perfectly *water-tight*, and the aqueous humor may therefore escape as fast as it is formed; or this fluid, which seems to be secreted chiefly from the posterior aqueous chamber, may be pent up there by the obstruction in the pupil, and so thrust the iris forwards against the cornea. In the former case, keeping the eye uninterruptedly

closed for two or three days, and giving the patient at the same time a little more stimulus or tonic, if his powers appear flagging, will consolidate the wound; in the latter case, the iris will slowly recede in proportion as the lens-matter in the pupil becomes absorbed, but will not, perhaps, quite resume its vertical position until the capsule shall have been broken through with the needle.

It occasionally happens that although the corneal wound, when examined on the fourth or fifth day, appears well united, it subsequently gapes a little at some point, and allows a small portion of the iris to prolapse, so as to displace the pupil.

3. The eye may be found in the following state: The cornea clear, its section gaping, and blocked up with prolapsed iris; the latter having been forced into the wound subsequently to the operation, and no attempt at union between the two structures having occurred, in consequence of the irritable, and at the same time feeble, condition of the patient. In such cases, the parts, on the fourth day after the operation, appear almost as if the wound had been just inflicted. Much chronic inflammation is sure to follow, probably attended with neuralgia. Such an eye should not be examined except when absolutely necessary; indeed, it is sometimes good practice to keep the lids uninterruptedly closed for five or six days after the first examination, provided their healthy appearance, and the absence of

puriform secretion, give assurance that the healing process is steadily advancing.

4. Still more unfavorable than the appearances just described are the following: A gaping section and prolapsus iridis, as in the case above described; but a cornea hazy throughout, so that the iris and pupil cannot be clearly discerned; the cut edge of the cornea being thickened, opaque, and *creamy;* the subconjunctival areolar tissue infiltrated with serum, and the conjunctiva itself reddened and elevated (*chemosis*).

These local changes have generally been preceded by pain in the eye and head, restlessness, and depression. Extreme care and watchfulness are necessary to carry a patient through a case of this kind. Narcotics may be required at night, and bark and ammonia are almost sure to render good service in keeping up the patient's appetite, and restoring his flagging circulation. His diet will require the strictest attention, that a sufficiency of nourishment may be taken into the system without oppressing it; but with all the surgeon's efforts, it will often happen that, after months of irritability and wearing pain, these cases terminate in closure of the pupil, with wasting and softening of the globe.

I may remark that, although it is so important, after all operations of Extraction, to defend the patient from strong light for several days, there is no necessity for closing window-shutters, and drawing curtains closely around the bed, if the patient's eyes are bandaged in the manner I have described. Very moderate shading of the room is sufficient, and thorough ventilation is most beneficial, for by duly aerating the patient's blood, the healing process is accelerated.* Indeed, one great advantage of operating during the finer season of the year, consists in the patient being enabled, within a fortnight or three weeks, to go into the fresh air. Nothing tends so much to prolong the Chronic Ophthalmia, which sometimes persists for many weeks after the cornea has healed, as *over-coddling;* while careful exposure to the fresh air, during genial weather, will often remove every trace of the affection.

A prolapsus iridis, remaining after the greater part of the section has closed, is always a source of irritation; but it should not hastily be meddled with, for in healthy subjects it usually wastes and dwindles away soon after the other portion of the wound has become thoroughly consolidated. When, however, instead of diminishing, it becomes distended by the aqueous humor into a vesicular projection, it may be punctured with a broad cutting needle; as soon as the fluid has escaped, the

* I do not mean that patients are to be subjected to currents of cold air, in accordance with Miss Nightingale's ventilation-schemes. Writing in our damp and variable climate, this lady says (Notes on Nursing, p. 12): "An open window most nights of the year can never hurt any one;" and she lays down another law, that "people don't catch cold in bed" (p. 9). I know not what meaning she may attach to the word "cold," but I warn my readers that if they treat Extraction cases after this fashion, their patients will catch—if not "colds," at any rate severe rheumatism and neuralgia, and in many cases will lose their sight too.

little prominence collapses, and it may then be lightly touched with a fine point of nitrate of silver. A few applications of this kind usually suffice to flatten down the prominence, and to consolidate the wound. The slightest possible touch is sufficient, just enough to faintly whiten the prolapse; even this will sometimes cause great pain and redness of the eye, with considerable muco-purulent secretion. If a case be not well watched until the wound has become thoroughly consolidated, it may even happen that a minute aperture in the prolapsus, not larger than the section of a human hair, becomes fistulous, and through this the aqueous humor gradually distils. After such a fistula has existed for some months, the whole cornea will have become hazy, and vision be irreparably lost.

I need hardly observe that, after a patient has been deprived of his lens by operation, an artificial substitute is necessary for distinct vision; a deeply convex glass (2_2 in., 2¾ in., or 3 inches focus) being employed for near objects—in reading or writing; and one less convex (3 or 4 inches focus) for objects at a distance. A patient originally myopic will require a glass of a much lower degree of convexity.*

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* While this sheet is passing through the press, I receive a very interesting communication from Dr. H. W. Williams, of Boston, U. S. describing the results of a perfectly novel plan which he has adopted in operating by Flap Extraction. He passes a very fine suture, threaded on a proportionately small needle, through the edges of the corneal wound. Its quick union is, he says, more certainly secured in this way, and all risk of prolapsus iridis obviated. The small suture does

LINEAR (MORE CORRECTLY "RECTILINEAR") EXTRACTION.

In 1811, GIBSON published a method of operating in certain cases of *soft* Cataract.* He advised that such Cataracts should be freely broken up with a needle, and that, *after inflammation had subsided*,—say in three or four weeks,—a small corneal incision should be made, and the remains of the broken-up lens removed with the scoop.

Now, if such a broken-up lens do not, in the course of three or four weeks, set up inflammation, it is probable that inflammation will not occur at all; and the fragments, if left alone, will all be absorbed in the course of some months. But if the lens should have been broken up too freely, and the fragments are causing inflammation of the iris and cornea, the surgeon ought not to wait in the hope that the inflammation may subside, but should at once make a small opening in the cornea, and allow the fragments which are causing the inflammation to escape.

As the true principles which regulate the absorption of the lens *in sitû* became better understood, GIBSON's operation fell into disuse. It was revived by GRÆFE, who published an account of

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not set up irritation, and it is left to come away of itself. Dr. Williams never operates without bringing the patient fully under the influence of ether, which he, in common with all the medical men of Boston, prefers under every condition to chloroform.

* Practical observations on an Artificial Pupil, with remarks on the Extraction of Soft Cataracts, &c.

it, with certain modifications, in 1855.* He advised that the incision, instead of being made at the margin of the cornea, should be at the distance of a line nearer its centre, and perfectly straight. He remarked that such a wound would heal more readily than a flap-wound, and would involve less risk of *prolapsus iridis.* On the other hand, a straight wound does not gape, and therefore requires more mechanical aid to help out the pulpy lens-matter.

The pupil having been dilated with atropine, the vertical incision through the cornea with a lance-knife was to be made to the extent of two, two and a half, or three lines. He then passed in his small, fleam-shaped cystitome, and with it broke up the capsule and surface of the softened lens. Next, a scoop was introduced through the corneal wound into the midst of the pulpy mass, and by pressing the scoop against the edge of the wound it was made to gape, and the broken-up lens-matter escaped along the groove.

GRÆFE by no means proposed this operation, which he called "Linear Extraction," as a *substitute* for the older flap-operation. He advised it specially in cases of fluid lens, the corneal incision being made two lines in length; or when the lens was almost of a pulpy consistence, in which case the incision would have to be made rather longer. When the lens had retained the normal consistence of adult life, and, still more, when it had acquired increased hardness, he considered the operation contra-indicated.

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* Archiv für Ophthalmologie, vol. i, p 217

It was by want of attending to these limitations of the operation, and by applying it to Cataracts that were of too firm a consistence, that it soon got into discredit. Many eyes were lost after "Linear Extraction," which I have no doubt would have been saved, if treated by the same operators, on the slower plan of solution *in sitû*, or Extraction by a flap-incision.

Somewhat akin to the operation of Rectilinear Extraction is that of removing softened Cataracts by "Suction." LAUGIER announced in 1847* that he had devised a quick and easy method of doing this, by introducing a sort of cannula through the sclerotic (he did not say through what else) into the substance of the opaque lens, and then, by means of a piston attached to the cannula, drawing out all the contents of the capsule. Soon afterwards BLANCHET described his method of operating with a somewhat similar cannula and syringe, but he advised that the cannula should be passed through a small wound in the cornea.

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* In Annales d'Oculistique, vol. xvii, p. 29. He termed his proceeding removal of Cataract "par aspiration." Very soon he was charged with having plagiarized his operation from some Italian surgeon, and an animated paper war ensued, evoking in its course much Arabic and even Hebrew learning, as to whether, after all, the Arabians had not anticipated the whole subject in dispute. Seeing that the Arabians were altogether ignorant both of the true site and nature of Cataract, it could really matter very little what they had said about the affair. Those who may feel interested in the "aspirations" of M. Laugier, and the Oriental criticisms of some of his opponents, may consult vols. xvii, xviii, xx, and xxiv, of the Annales.

BLANCHET'S operation has lately been revived, with a still further modification, whereby the lens-matter is sucked out by the surgeon through a flexible tube held in his mouth.*

The solution of a softened Cataract *in sitû*, in the way described at p. 303, appears to me to be in the great majority of cases, far better, because safer, than any of the procedures just described. *Sat citò si sat benè* is a good motto to bear in mind, when a faculty so precious as sight depends on the surgeon's care and skill.

In many cases of Cataract it is impossible to say absolutely to what extent the softening process may have extended, and what bulk of hard nucleus may still remain. It often happened, therefore, that the surgeon who had commenced the rectilinear operation in the belief that the lens was in a pulpy condition, found himself embarrassed with a firm nucleus of considerable size. The removal of this mass necessitated so much mechanical interference, that the iris became bruised and injured, and in addition, fragments of broken lens got behind it, and set up the most serious irritation. These and other complications, seem to have led Græfe to attempt a mode of operation whereby the iris might be saved from injurious pressure, and at the same time additional room be afforded for the removal of even a firm nucleus through a comparatively small corneal wound.

These attempts resulted in the present "Scoop-Extraction."

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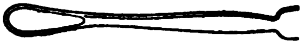
* Ophthalmic Hospital Reports; vol. iv, p. 197.

And here I may observe that, whatever may be the final verdict which, after more extended experience, may await the operation of Scoop-Extraction, its invention is wholly due to GRÆFE, who to a great degree has been deprived of the merit of having originated it.*

There is no doubt that one of the chief causes of failure after a well-performed Flap-Extraction is the occurrence of prolapsus iridis, and by the iridectomy proposed by GRÆFE all possibility of this was of course avoided. At the same time ample room was made for the removal of a large and solid nucleus, and through a less gaping wound than the crescentic incision of Flap-Extraction. By the use of a scoop to draw out the nucleus all pressure on the globe was rendered unnecessary. The following wood-cut is copied from a scoop made for GRÆFE in 1857.†



Scoop-Extraction seems most suitable to those Cataracts which are in an intermediate condition between the semi-fluid state which admits of a complete evacuation through a rectilinear incision, and the hardness of those in which little or no superficial change has taken place.

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* The operation was very fully described by him in the fifth volume of the Archiv für Ophthalmologie; pp. 158–173, 1859.

† Dr. Schuft, one of Græfe's assistants, modified this scoop by raising its edges, and so deepening its cavity; and on the strength of this slight change in Græfe's instrument the invention of Scoop-Extraction has been very generally awarded to Schuft, and it has actually been called "Schuft's operation!" Mr. Critchett has invented a far better scoop than any that had preceded it, to which he gives the name of "vectis."

From the diminished risk of escape of vitreous humor during Scoop-Extraction, in consequence of the smaller corneal wound and the absence of pressure on the globe, the vomiting which so often follows the use of chloroform is of less consequence than in Flap-Extraction; and therefore it may be administered in operations with the scoop, although in very quiet patients it may not be necessary.

The lids being well separated with a spring speculum, the surgeon fixes the globe, by nipping up a fold of ocular conjunctiva below the cornea. He then passes in a lance-knife at the upper edge of the cornea close to its junction with the sclerotic.* Next a forceps is passed in at the wound, a portion of iris seized, drawn out, and cut off. The cystitome is then used to lacerate the anterior capsule, which should be done to the full extent of the enlarged pupil. Lastly, the scoop is insinuated behind the upper edge of the nucleus, and carried on until the beak of the instrument has passed just beyond the lower edge. The entire nucleus is then gently drawn out.

This sliding of the scoop behind the lens is the act of the operation which requires the most care, for by rudely thrusting the instrument too much backwards, its point might be made to break through into the vitreous humor. The surgeon must bear in mind the convexity of the hinder face of the lens, and give to the beak of the scoop a corresponding curved sweep.

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* In his first description of the operation, Græfe (*vide supra*) advised that the cornea should be incised at its outer edge; but the deformity, and other disadvantages resulting from an over-large and misshapen pupil, are better obviated by making the incision upwards.

It will depend upon the degree of softening which the surface of the lens has undergone, how much pulpy lens-matter will remain behind after the nucleus has been drawn out. As much of this pulp as can be got away without risk of breaking into the vitreous humor, should be removed; but provided no solid nodules remain, the surgeon need not be over-anxious to get out every particle of soft matter. Each reintroduction of the scoop tends in some degree to irritate the edges of the corneal wound, and there is always the risk I have adverted to of breaking through with the instrument into the vitreous humor. The corneal incision being left clear of any lens-matter, the bandage may be applied over both eyes, as after Flap-Extraction.

On examining the eye for the first time, the surgeon will sometimes find that the whole, or nearly the whole, of the enlarged pupil is filled with a flocculent or pulpy mass; but provided the wound be united, and the cornea clear, this obstruction of the pupil need not disquiet him. All will in time become absorbed, or if any considerable quantity should eventually remain, it may be cleared away by the aid of two needles, used in the manner I have described at p. 317.

In most cases the softened periphery of the lens is sufficiently opaque to be readily seen at the time of the operation; but it is sometimes so nearly transparent as to be very difficult of detection, and it only becomes opaque and strikingly visible two or three days afterwards.

Although, from what I have said, it will be seen that the two great accidents which attend or follow Flap-Extraction,—loss of vitreous humor, and prolapsus iridis,—may be evaded by a carefully performed scoop-operation, let not the reader suppose that the latter mode is to be regarded as "Extraction made easy," or that success is always to be looked for. Cases occur in which, after the most careful Scoop-Extraction, infiltration and softening of the cornea will take place; or a more chronic form of irritation ends in permanent opacity of a large portion.

GRÆFE's Scoop-operation with Iridectomy has undergone several modifications. One consists in first performing Iridectomy, then waiting till the corneal wound is healed, and the anterior chamber is restored; and then, by a second operation, removing the Cataract with the scoop.

Another modification is as follows. A crescentic incision of the cornea is made, and the lens removed, as in ordinary Flap-Extraction. A forceps being then passed in at the wound, the iris is seized, drawn out, and cut off, just as in the operation for Glaucoma; the whole operation being performed while the patient is under chloroform.*

I need hardly say that, *provided all goes well*, the final result of the Flap-Extraction is indisputably superior to that done with the scoop after Iridectomy, both as regards vision and the appearance of the eye. The round central pupil of the former operation contrasts very favorably with the large misshapen aperture of the latter, which is sometimes the cause of very annoying refraction of the rays from luminous objects. It is as yet too soon to sum up completely the relative merits of the two modes of operation, and meantime extravagant praise or dispraise of either can only increase the difficulty of arriving at a calm verdict.

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* We are told by Dr. Jacobson that one hundred consecutive operations, performed by this method, on patients indiscriminately taken, were *all successful.* Chloroform was used in all cases, and in some retching and vomiting went on for several hours after the operation. One asks, "What is success?" Does it mean getting the opaque lens out of the eye? Or does it imply a clear cornea and the patient's restoration to good sight? A little experience of the world makes one very incredulous as to uniform success in anything. Least of all do we look for it in medicine and surgery, where results must so often depend upon circumstances in the patient's condition, over which the best science and skill can have little or no control.

CHAPTER XVII.

THE OPERATIONS FOR ARTIFICIAL PUPIL.

THIS term may be understood to signify, not only the formation of a new aperture in the iris, when the natural pupil has become obliterated, but also any operation performed on the latter for the purpose of changing its size or position.

1. *The formation of a new aperture* becomes necessary whenever an extensive wound of the cornea —such, for instance, as that inflicted in the operation of Extraction—has been followed by a large prolapsus of the iris, which has obliterated the pupil by drawing its margin into the cicatrix. A similar obliteration is produced by extensive loss of corneal substance; such as attends Gonorrhœal and severe Purulent Ophthalmia, and various forms of mechanical and chemical injury. Occasionally a new aperture may be formed, with the most striking benefit in cases where, in consequence of Iritis, the margin of the natural pupil has become adherent to the capsule of the lens, and the area of the pupil filled with a layer of old inflammatory deposit, the cornea remaining healthy, and the periphery of the lens itself preserving its original transparency.

2. *The natural pupil requires to be artificially enlarged or displaced*, in cases similar in kind to the

foregoing, but differing from them in the degree of obliteration.

a. Where, for instance, a portion of the pupil having prolapsed, the rest still remains free, but is overshadowed by the cloudy edge of a corneal cicatrix, with which the greater part of the pupillary margin is identified.

b. Where the iris and pupil are in a perfectly normal condition, but are more or less completely hidden by a dense central opacity of the cornea.

Cases in which the pupil becomes blocked up with a film of inflammatory deposit, and, at the same time, diminished to a mere point, after extraction of a Cataract, might properly be considered under the head of *Artificial Pupil;* but they have already been spoken of among the operations on "Opaque Capsule" in a preceding chapter.

In determining which form of Artificial Pupil operation is to be preferred, in any of the cases above enumerated, the presence or absence, the transparency or opacity, of the lens must be taken into serious consideration.

In some of the instances alluded to in the latter portion of par. 1, and at *a.* of par. 2, *ante,* the lens is very commonly absent, having escaped through the ulcerated or sloughy opening in the cornea; but this is not always the case, and the reader will at once perceive how much more care must be required in removing a portion of iris from before a transparent lens (any injury to which would produce Cataract), than in removing a similar portion after the lens has been lost, Without entering into those minute points which individual cases may offer for consideration, I will just mention a few general rules which should guide the surgeon in operating for Artificial Pupil.

1. In most cases it is undesirable to operate when the other eye is sound.

2. An Artificial Pupil should not be attempted in an eye which has lost all perception of light:

3. Nor where inflammatory action is still going on, or has only very recently subsided.

4. Great care must be taken not to mistake for true cornea the semi-transparent fibrous tissue which sometimes overspreads the iris in the condition termed *Staphyloma.*

5. The history of the case must be minutely inquired into, to ascertain the presence or absence of the lens.

6. The pupil should be made as nearly central as possible, provided the cornea in that situation be sufficiently transparent.

7. If the artificial pupil be clear and well defined, a small aperture is better than a large one.

The rule, to inflict upon the parts as little violence as possible,—which holds good of all operations,—is peculiarly applicable to those for Artificial Pupil; for they are always performed on eyes that have already suffered from inflammation, and sometimes to a very considerable extent.

Where only a very narrow strip of cornea has retained its transparency, it is especially important that the iris should be reached through a very small corneal wound; because the opaque cicatrix, which every such wound necessarily gives rise to, takes away some space from the patient's already limited field of vision.

There are four principal ways of making an Artificial Pupil; by *Laceration*, by *Incision*, by *Excision*, and by *Ligature*.

I mention the first only to express my disapproval of it, as a rough, clumsy, and unscientific proceeding. It is commenced by making an incision in the cornea, through which a sharp hook is passed into the anterior chamber as far as the ciliary margin of the iris. When the point of the hook has reached that spot, it is stuck firmly into the iris, and then, by slight traction, the iris is torn away from its attachment to such an extent as may be desired. The hook is then disengaged, and withdrawn from the eye.

A pupil of this kind is often difficult to make, and usually very inefficient when made. Its position—so far from the axis of vision—is the very worst that can be chosen; its form and dimensions cannot be regulated with any certainty; the vessels and nerves of the iris are torn just where they attain their largest size. In short, one has but to examine a case of accidental separation of the iris from the ciliary ligament,—such as occasionally follows a blow on the eye,—to be convinced how very imperfectly a pupil in this situation can answer the purposes of the natural aperture.

The operation by Incision is founded on the readiness with which the fibres of the iris, if put upon the stretch, will retract on being divided. It is most easily performed, therefore, in those cases in which the entire pupillary portion of the eye has prolapsed through a wound in the cornea, and subsequently become adherent to the cicatrix.

It would be unsuitable where the iris had suffered much from inflammation, as, in that case, the fibres of the part would have lost their retractile force; and it would be dangerous where the lens was still *in sitû*, for the instrument would almost inevitably inflict an injury on that body, and so produce a Traumatic Cataract.

The operation is performed by passing a broad cutting-needle, or very small knife, through the cornea, and between it and the iris; then the edge of the instrument is turned towards the part to be divided, the point is thrust quite through the iris, and its fibres severed to such an extent as may be desired. If the instrument be not extremely sharp, and dexterously used, the iris, in the attempt to cut it, may be so dragged as to cause its ciliary attachment to give way.

MAUNOIR's method of dividing the iris with scissors, in addition to other difficulties, has the defect of requiring a large corneal wound to be made before the scissors can be introduced; and, however simple it may look in a diagram to make a V-shaped incision in the iris, any one who has tried to do so on the dead subject will have found that even the finest and sharpest scissors cannot divide, with precision, such a flabby and yielding tissue as the iris becomes the moment the aqueous humor has escaped.

From what I have said, it is evident that the operation by *Incision* is applicable to only a limited class of cases, and most of these can be still more advantageously treated by the *Excision* of a portion of the iris.

For the means of accomplishing this in a far safer and better way than had previously been done, we are indebted to TYRRELL; and of all the suggestions for the improvement of ophthalmic surgery which are to be met with in his Practical Work, none has so well borne the test of experience as the use of his "blunt hook."

With certain modifications of construction as to the length of the bent portion, this is the instrument I generally prefer for drawing out a portion of the iris in the operation by Excision, even where the lens is absent; where it is *in sitû* and transparent, the blunt hook is almost the only contrivance that can be used without great risk of wounding the capsule, and so producing Cataract.

It is so important to prevent the premature escape of the minute quantity of aqueous humor which still remains in some cases of old injury to the cornea, that all unnecessary pressure on the globe must be avoided. The lids, therefore, should be held apart with a spring speculum, and the eyeball steadied by pinching up with a broad-bladed forçeps a small fold of the ocular conjunctiva.

The surgeon, having carefully planned the position in which the Artificial Pupil can best be made, with the broad cutting-needle penetrates the cornea, close to its junction with the sclerotic. By using the cutting edges of the needle, the little wound may be widened to such an extent as will permit the hook to be easily passed in and out; and, with due care, the greater part of the aqueous humor may be retained until the hook has actually entered the aqueous chamber. Its employment there will be regulated by the circumstances of the case.

If the natural pupil has become wholly obliterated—in consequence of its entire margin having prolapsed into a breach of surface in the cornea—it may be found advisable to take advantage of the moment when the cutting needle is first passed into the anterior chamber, to pierce the iris, so as to obtain a hold for the hook; but if a special form of the latter instrument be adopted, it may be thrust through the iris without any preliminary puncture having been made with the needle.

As soon as the iris is firmly fixed in the bend of the hook, the handle of the instrument is to be rotated, so that the convexity of the short, bent part may face forwards, or towards the cornea. This turn must be given to the instrument in every form of its application; for, otherwise, when it is being brought out, its point is almost sure to catch in the corneal wound.

The hook, with a portion of iris in its hold, having been slowly and gently withdrawn through the wound, an assistant, with a pair of fine scissors, cuts through the iris; close to the hook, if only a moderately-sized pupil be needed, or close to the cornea, should a larger one be desirable.

Lastly, any portion of the iris which may hang in the wound is to be returned into the aqueous chamber by means of the little spatula. In this way the iris is restored to its natural plane, and the corneal wound, being freed from any obstruction, rapidly heals.

In cases where the greater part of the pupillary margin is blended with a corneal cicatrix, but where a small aperture still exists, a free edge is of course presented to the hook, and the withdrawal of a portion of iris becomes comparatively easy.

If both iris and lens be in their natural condition, and the obstruction to vision be owing to a central opacity of the cornea, the surgeon's object will be to remove such a portion of the margin of the pupil as will cause its area permanently to extend beyond the edge of the opacity. As the lens is transparent, great care must be taken in so hooking the pupillary margin as not to tear the capsule; otherwise, opacity of the lens will be produced, and *Cataract* added to the difficulties of the case.

L's blunt hook, with a shortened bend,

will suffice to form almost every kind of Artificial Pupil. By employing it, the quantity of iris to be removed can be regulated with much more precision than is possible by introducing a forceps into the anterior chamber, although, in some special cases, the " cannula-forceps" may be used with advantage.

All *sharp* hooks are open to the objection of being difficult of removal from the eye, after they have done their work in seizing the iris. Their use in cases such as I have just described, where the lens is still *in sitû* and transparent, is obviously contra-indicated.

Mr. Critchett has devised an ingenious operation, which he terms "Iriddesis,"* as suitable to a limited class of cases; for instance, where prolapsus iridis has occurred, and so much of the pupillary margin has been drawn into the cicatrix as to reduce the area of the pupil to a very minute aperture; or where the whole pupil has been displaced towards the extreme edge of the cornea and overshadowed by an opacity. A puncture is made through the cornea, sufficient for the introduction of a cannula-forceps; a small portion of iris near its ciliary attachment is grasped, drawn out through the wound, and tied there with a very fine ligature. This transforms the pupil into a long slit. A second portion of iris is then similarly tied in a suitable position, and the elongated pupil assumes a triangular figure, its natural margin being uninjured, and its motory power, therefore, in some measure, retained.* By using TYRRELL's hook to catch the free edge of the pupil, instead of grasping the plane portion of the iris with forceps, a smaller corneal wound is required; this is an advantage, for the smaller the wound the less likelihood there is of the little bit of ligatured iris slipping back again into the anterior chamber.

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* Rather, I would suggest, "Iridodesis," or "Iriodesis." (See Note F. at end of the volume.)

I have hitherto made no attempt to lay down any general rule as to the direction in which an Artificial Pupil ought to be made; for all the cases I have described present peculiarities, in the relative extent and position which opaque and clear cornea bear to each other, such as must determine the situation to be chosen for the newly-formed aperture.

There are, however, certain cases in which the surgeon has a free choice as to its situation; the whole cornea being transparent, while the natural pupil has become contracted, and closed up with opaque deposit, in consequence of old Iritis. I have alluded to such cases in an early part of the present chapter. Considerable differences may exist among them as to the condition of the lens; which, in some instances, may be wholly opaque, while, in others, it may be simply overlaid by the opaque deposit in the pupil, and transparent throughout the rest of its extent.

In examining these eyes under the influence of atropine, we may possibly detect some minute, dark spot at the edge of the pupil, which may afford proof of a space, however small, existing between the iris and the capsule. This space may be just sufficient to admit the point of the blunt hook, and its situation may determine the direction in which the iris ought to be drawn out. Otherwise, I prefer to draw the pupillary margin either directly downwards, or outwards.

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* Ophthalmic Hospital Reports, 1858, vol. i, p. 220.

The *after-progress of an Artificial Pupil* varies according to the structural condition of the iris. If this part be in a healthy state, and its tissue strong and elastic, it does not give way under the hook, and, when cut with the scissors, it exudes a minute quantity of blood, which is absorbed in the course of a few days. If, on the contrary, there has been long-continued Iritis, the texture of the iris becomes soft and easily torn. The hook passes through it as it would pass through a piece of wetted blotting-paper; the edges of the rent do not retract; and the enlarged vessels pour out their blood into the anterior chamber, where it may remain unabsorbed for many weeks, or even months.

After-treatment.—If we have been startled at finding such wholesale depletion recommended after the operation of *Extraction*, what shall we say on reading that, "as a general rule, the patient should be *bled largely after any of the operations for the formation of an Artificial Pupil!*"—that this bleeding is to be to the extent of fourteen ounces; in some instances to twenty-four, or from that to thirty ounces; that if the diminution of pain be only temporary, and after a few hours begins to increase, recourse must again be had to bleeding; and that if *this* should not be sufficient to arrest the progress of the disease, it must be immediately treated as a case of Iritis, and mercury administered in such a manner as to affect the system as rapidly as possible!*

Certainly my own description of the after-treatment both of Artificial Pupil and Extraction, must appear very tame, when I confess that I have never conceived the thought of bleeding in any case of either kind.

All that is requisite, after making an Artificial Pupil in the way I have described, is that both eyes should be bandaged, so as to insure perfect repose to the operated one, for a few days. On the second or third day the eye may be examined; and, should there be much sclerotic injection, or intolerance of light, the bandage must be replaced, and the eye allowed to remain undisturbed for another day or two. Usually, by the end of a week from the operation, a large eye-shade will be found a sufficient protection. Very great care must be taken to prevent the patient too soon exposing the eye to strong light, especially if the case be one in which there had been for several years no perception of objects. Patients restored to sight after many years of blindness derive such pleasure from trying their newly regained faculty, especially in observing light and colors, that too much caution cannot be impressed upon them on this head. With excitable subjects, it is sometimes desirable to give a narcotic in the evening after the operation; but this may usually be dispensed with. As regards diet, there is no reason for denying the patient a moderate quantity of plain, digestible, animal food, even on the day of the operation; and it is unwise wholly to forbid the use of such stimulants as he has been accustomed to.

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* Guthrie; Lectures on the Operative Surgery of the Eye. Second edition, 1827, p. 516.

Of course, a patient who is confined to bed, or to an easy-chair, is not to live as freely as if he were taking exercise out of doors; but it is a great mistake to suppose that he is to be wholly deprived of his accustomed stimulants because he has had a small puncture made in his cornea, and a minute portion of his iris removed. Old people, especially, can ill bear such reduction; and it will often happen, where a little bleeding into the anterior chamber has taken place from the wound of the Iris, that a glass of beer or a glass or two of wine, taken with the meals, will greatly hasten the absorption of the effused blood. Fomenting the closed lids with warm water, if found soothing, may be repeated night and morning.

CHAPTER XVIII.

OPERATIONS FOR STAPHYLOMA, STRABISMUS, ETC.

THE removal of a *Staphyloma* is resorted to either for the purpose of getting rid of a deformity, or on account of the pain which sometimes attends the protrusion. There are also other morbid enlargements of the eye, hardly to be classed under any one specific term, which all require, for their permanent cure, either the evacuation of the humors of the globe or its complete removal. These enlargements may be caused by various kinds of spontaneous inflammation, or may be the slow result of wounds. In either case, it is not uncommon for the lens to become filled with a deposit of phosphate of lime; and this earthy mass, by pressing against the iris and ciliary processes, often causes extreme pain. In excising a Staphyloma, therefore, it is necessary to make an opening sufficiently large to allow of the lens being removed, should it be still existing within the globe.

Another reason for making a free opening is to facilitate the escape of the blood, which is sometimes abundantly poured from the choroidal vessels into the vitreous chamber. When this hemorrhage occurs, and suddenly fills the cavity of the unyielding sclerotic, intense pain is produced, and the operation therefore is one of those which should be performed under the influence of chloroform.

The lids being separated by the fingers of an assistant, the surgeon passes a cataract knife through the cornea, or the fibrous tissue which replaces the cornea in cases of true Staphyloma, so as to make a flap rather smaller than that for ordinary Extraction; this is instantly seized with a forceps, and removed with a stroke of the knife. The aqueous humor, or the serum which has replaced it, of course escapes as soon as the first wound is made; perhaps the lens slips out when the wound is enlarged; or should that body have been previously lost or absorbed, vitreous humor, more or less changed in consistence, is alone ejected; if the lens do not escape with the humors, it must always be removed.

I have said that the sudden removal of pressure from the enlarged choroidal vessels is very apt to cause them to give way. I have sometimes endeavored to obviate this, by making, with a broad cutting-needle, a preliminary puncture through the staphylomatous projection, so as to allow its watery contents to escape, and in this way to prepare the bloodvessels for that total loss of support which follows the gush of vitreous humor. But I believe the most likely way to prevent excessive hemorrhage is to apply pretty firm pressure to the eye through the closed lids, by means of a cold sponge, the instant after the operation has been completed.

As soon as hemorrhage has ceased, or all risk of its taking place is gone by, water-dressing may be applied. When bleeding has occurred, copious discharge of sanies continues for several days; and the globe gradually shrinks so as to allow of an artificial eye being worn. Sometimes great constitutional disturbance follows the operation, and must be met by suitable treatment of a soothing kind; or, at a later period, pus may form within the clot, and require evacuation.

Mr. CRITCHETT has modified the operation for Staphyloma as follows: He passes in several curved needles, armed with ligatures, above the base of the Staphyloma, and brings them out at corresponding points below. He then cuts away an elliptical portion from the front of the swelling, draws the ligatures quite through, and ties them in knots, which then lie just across the line of his closed incision. (Ophthal. Hospital Reports; vol. iv, p. 1.)

OPERATIONS FOR STRABISMUS.

Tenotomy, as applied to Strabismus, has been much simplified since its first introduction in 1840. The variously-shaped knives which at that time were invented have been pretty generally superseded by the scissors, and little stress is now laid upon the exact amount of curve to be given to the director, or blunt hook.

On the other hand, there has been increased care in selecting suitable cases. A knowledge also of the gradual changes in respect of position, which an eye may undergo long after the most careful operation, has taught the conscientious members of our profession to be guarded in their prognosis; while, at the same time, we no longer see long lists of cases, *all successful*, such as were published in the earlier days of Strabismus operations.

In most cases, and always with children, it is necessary to use chloroform, but where a patient has had sufficient self-command to undergo the operation without it, the surgeon can feel much more certain that the muscle has been properly divided, by ordering him to attempt movements of the eye in the direction of its former malposition. The internal rectus is divided so much more frequently than any other muscle, that I may select that operation to illustrate my remarks.

The patient should lie down, with the shoulders elevated. The operator then separates the lids with a spring speculum, and an assistant, with a broad-bladed forceps, pinches up the ocular conjunctiva, to the *outer* side of the cornea, and so draws the eye away from the median plane. Having raised a fold of conjunctiva about midway between the cornea and the plica semilunaris, the surgeon divides the membrane horizontally, with scissors, a little below the level of the lower edge of the cornea.

He then snips through the subconjunctival tissue, and having quite exposed the sclerotic, slides upwards between it and the rectus muscle a curved director. This raises the tendon and makes it tense, and then with several snips of the scissors it is cut through, close to its insertion into the sclerotic.

If the patient now attempts to turn the eye inwards towards any object, he is unable to do so, except to a very slight degree. The limited power of adduction still remaining, is chiefly due to the attachment by areolar tissue between the belly of the muscle and the sclerotic, partly, perhaps, to the action of the innermost fibres of the superior and inferior recti. If the power of adduction be too strong, a search must be made with the hook for some undivided fibres of the internal rectus, and these must be well divided before the speculum is withdrawn.

Whether the muscle be divided subconjunctivally, or brought clearly into the wound before division, care must be taken not to disturb the connections of the conjunctiva more than is necessary for fear of giving rise to a shrinking back of the plica semilunaris and caruncle. There is perhaps less risk of this taking place when the operation is performed on GRÆFE's plan, by making an opening in the conjunctiva on the equator of the globe, a few lines internal to the cornea, passing a curved hook beneath the tendon, and bringing it into view before dividing it.

Sometimes the areolar tissue, which has been disturbed during the operation, becomes infiltrated with blood, and forms a little prominence in the wound. The winking of the lids gradually moulds this mass into a small button-like excrescence, attached by a narrow pedicle, which may require to be snipped through some weeks after the operation.

Division of the *external rectus* is rarely required, but it may be resorted to for the purpose of remedying the unsightly abduction which sometimes occurs when a former section of the adductor muscle has been accompanied with too extensive separation of its connections. It must be borne in mind that the external muscle is broader than the internal, and is inserted at a greater distance from the margin of the cornea.

In extreme cases of this unsightly abduction the mere division of the external rectus is not sufficient. Immediately afterwards the conjunctival and subjacent tissue, together with the retracted internal rectus, are to be dissected up in one flap, and its pared edge united to the corresponding raw edge near the margin of the cornea. This gives a more anterior attachment to the retracted adductor, and at the same time draws out the plica semilunaris and caruncle.

ENTROPION AND ECTROPION.

In the chapter where the appearances of these affections of the lids are described (Chap. XIV), I have very briefly alluded to the various operations employed for their cure. The main object of the present work being to direct attention to the outward phenomena of those diseases which affect *tissues peculiar to the eyeball*, I have devoted comparatively little space even to the important operations in which those tissues are concerned. The Operations of Entropion and Ectropion, therefore, involving as they do merely such tissues as are met with in other parts of the body, need not here be specially described. The works of MACKENZIE and WALTON, already alluded to, may be consulted for fuller details concerning plastic operations on the lids, and other parts adjacent to the eye.

REMOVAL OF THE EYEBALL.

As Pathology advances, this operation becomes more rare in cases of malignant disease—the very instances in which it formerly was chiefly employed. Meantime, its performance has been rendered much less formidable by the adoption of BONNET'S method, whereby, instead of scooping out all the contents of the orbit, the globe alone is removed by making a circular incision through the conjunctiva and ocular fascia, and then successfully dividing each muscle of the eyeball close to its point of insertion, and the optic nerve just before it pierces the sclerotic. A much smaller wound is made by this method than by the older one, and there is also less bleeding.

Instead of raising with a hook all the tendons of the ocular muscles, one after the other, and dividing them before cutting through the optic nerve, I operate in the following way, which is simpler and more rapid. Having inserted the spring speculum between the lids, and made with curved scissors the usual circular division of the conjunctiva, I grasp the external rectus and its surrounding fibrous tissue with a forceps, and snip them across; an assistant seizes the cut tendon and draws the eye inwards. Sliding one blade of the scissors under the superior rectus and oblique muscles, they are divided; and then the inferior rectus. The optic nerve is next snipped through, and the globe starts forwards. A few strokes of the scissors divide the internal rectus, vessels, and bands of areolar tissue, and the operation is completed.

Removal of the eyeball should never be resorted to so long as any useful sight remains in the organ; unless, indeed, such an amount of irritation be present as may lead the surgeon to fear that, by allowing the diseased organ to remain, the sight of its fellow might be endangered.

I may, in conclusion, say a few words respecting the employment in Ophthalmic Surgery of Chloroform. We may regard it under two aspects: as saving the patient from pain, and as facilitating the manipulations of the surgeon.

Now, it is notorious that operations performed on the globe itself cause very little pain, and last but a very short time. Those on the lids, involving as they do the wounding of skin, are of course more painful; but in respect of the suffering they cause, none even of these are comparable to the larger operations of General Surgery; and there are few adults who, if thoroughly informed as to the real nature of such operations as those for Cataract, Artificial Pupil, and Strabismus, or even Entropion and Ectropion in their slighter forms, will not readily undergo them without the aid of anæsthetics.

A perfectly passive condition of the eye is so desirable in the delicate operations of Cataract and Artificial Pupil, that one would naturally expect to find chloroform universally applicable in such cases; and specially indicated in the most delicate of all, namely,—Extraction. But one kind of Extraction,—in which the flap-wound of the cornea is employed—forms, I think, a peculiar and exceptional case, and for the following reason:

We have seen that—provided the operation have been properly performed—the successful result of Flap-Extraction chiefly depends upon the rapidity with which union of the corneal wound can be effected. Now with every precaution, it will sometimes happen that chloroform induces vomiting; and the violent efforts which attend this may disturb the lips of the wound, and cause the iris to prolapse between them, or even induce prolapse of the vitreous humor, with all its accompanying irritation and retarded union. But without taking such an extreme case as this, we shall find a very serious objection to the use of chloroform in the fact, that the squeamishness and disrelish for food which it induces may interfere with the reparative process, by impairing the nutrition of the cornea during the critical twenty-four hours immediately following the operation.

In adults who are extremely fearful and unsteady, chloroform may be required in the operations for Artificial Pupil and Strabismus; it will always be indicated in cases of Extirpation of the Globe; and it may greatly facilitate the examination of the eyes rendered irritable by disease or by the presence of foreign bodies.

In children, all these manipulations will be greatly facilitated by the use of chloroform, and some can hardly be performed at all without its aid. The recumbent position is, of course, necessary in every instance of its employment.

In spite of all sorts of improved apparatus, and the knowledge we have now arrived at as to the chief sources of danger connected with the administration of chloroform, there still remains the painful fact that, every now and then, people are killed simply by inhaling it. Such persons, indeed, bear an infinitely small proportion to the number of those who take it with perfect impunity. They form "exceptional cases;" but in a matter of this kind no one likes to be the "exception." While chloroform must ever remain an inestimable boon to mankind, enabling the surgeon to save life by operations which without its aid would be quite unendurable; while in Ophthalmic Surgery, it makes some of the most delicate and difficult manipulations comparatively easy; it certainly should not be given, as a matter of course, for every trifling operation; nor be regarded as a universal substitute for that courage and self-command which a surgeon has a right to expect from rational patients.

NOTES.

NOTE A.

PORTERFIELD believed, and, to his own satisfaction, demonstrated, that in adjusting the eye to view near objects the lens was moved slightly forwards; and this movement he attributed to the action of the muscular fibres which he maintained to exist in the *ligamentum ciliare.* "The eye," he says, "in its natural state is adapted only to distant objects, and cannot see near objects distinctly but by an effort of the mind, contracting the Ciliary Ligament, which therefore is then in a state of violence." "The effort that is necessary for contracting this ligament is the reason our eyes are so soon fatigued in looking to near objects." (Vol. ii, p. iv.)

The whole of Chapter III of Vol. I, is devoted to explaining "the change that is made in the eye in order to see distinctly at different distances, and the use of the Ciliary Ligament in producing this change." **PORTERFIELD** maintained the true muscularity of the so-called "Ligament," and, in opposition to those who denied it because red fibres could not be seen in it, says, "Everybody knows that our muscles are generally of a red color; but it does not thence follow that what is not red is not musculous."

A reader limiting himself to these passages from

PORTERFIELD might fancy that in them the modern theory of Accommodation, so far as concerns the force immediately acting on the lens, was fully set forth. But when we examine farther, we find that PORTERFIELD included under the term "Ciliary Ligament" not only what we now call the "ciliary muscle," but also the whole of the ciliary processes; and it was, he believed, by the united action of this contractile mass that the lens was moved forwards. This movement, YOUNG observed, "the ciliary processes are, from their structure, attachment, and direction, utterly incapable of." (Phil. Trans., 1793, p. 170.)

NOTE B.

A few words may prevent misunderstanding as to the progress of YOUNG'S opinions about Accommodation. He was not quite twenty years of age when he communicated to the Royal Society his first paper on the structure of the lens and the accommodation of the eye. He imagined he had discovered the true structure of the lens, which he declared to be a *muscle;* even describing the course of its fibres, and of the *tendons* into which these fibres were inserted. At the same time, he distinctly asserted that the accommodation of the eye to near objects was due to a change of figure—increased convexity—of the lens.

Subsequently he seems to have found that he had been anticipated (by PEMBERTON in 1719) as to this theory of the lens being muscular; and he appears also to have been so much impressed by the high names of HOME and RAMSDEN, whose conjoint experiments had, to their own satisfaction, proved Accommodation to be due to a change in the curvature of the cornea, that he withdrew the theory he had advanced in 1793.

In 1796, he took his M.D. degree at Göttingen, and at the end of his Inaugural Dissertation he printed eight Theses, in one of which, the seventh, he very frankly and explicitly admits his error. Expressly referring to his paper of 1793, he says, "Sententia nuper de lentis crystallinæ usu in oculo ad diversas rerum videndarum distantias accommodando proposita, neque nova erat, neque vera videtur." (De corporis humani viribus conservatricibus Dissertatio. Auctore, Thoma Young, &c. Gottingæ, 1796.)

Farther research, however, induced him to modify one of his statements of 1793, and to reassert the other; and in the Bakerian Lecture, read in 1800, and published in the Philosophical Transactions for the following year, while he retracted his theory of the lens being muscular, he at the same time forcibly insisted on Accommodation being wholly due to a change of form in the lens; declaring his conviction that this change was due to a power within the lens itself, and altogether unaided by any muscular tissue in other parts of the eye.

(See "Life of Young," by Peacock. 1855.)

NOTE C.

There is no doubt that *ἄμετρος* was commonly used by Greek writers as the antithesis to *ἔμμετρος*. In the Thesaurus of Stephanus examples of this will be found, from Plato and from Julius Pollux. But *ἔκμετρος*, if not absolutely identical in meaning with *ἄμετρος*, so nearly resembles it as completely to warrant the use of such a compound word as *ἐκμετρωπία*.

NOTE D.

DONDERS, in his "Historical Remarks on Myopia" (*op. cit.*, p. 447), omits the name of PORTERFIELD; and yet this writer seems to have come very near the present theory of the affection. He says, "By Myopes I understand such as have the cornea or crystalline, or either of them, too convex, or that have the distance betwixt the retina and crystalline too great." ("A Treatise on the Eye," &c. Edinb., 1759. Vol. ii, p. 36.)

NOTE E.

The term *Astigmatism* was invented by WHEWELL, to designate the peculiar condition of irregular refraction described by AIRY as existing in his own case. The word is obviously formed from *a* and *στίγμα* (*στίγματος*), a point, and implies that the rays of light do not converge to a single point, or focus. In the absence of artificial glass lenses, the Greeks possessed no means for making rays of light "converge to a focus," in the modern sense of the phrase, and therefore we should in vain seek for any precise Greek synonym for the point at which such rays unite.

From the quotations given in Lexicons (see, for example, the Thesaurus of Stephanus) it would seem that the point implied by *στίγμα* (*στίγματος*) was always something material, more or less visible or tangible—a mark, spot, or puncture—not a "point" in the geometrical sense. For the latter the Greek writers used the word *στίγμη* (*στίγμης*); Euclid, by the way, has *σημειον*. Now, what we wish to imply by *focus* is, the "point" where luminous rays meet, without producing any material change in the medium in which their meeting takes place; and στίγμη seems exactly to answer to this definition. The faulty refraction, therefore, which causes rays of light falling on the vertical meridian of an eye, and those falling on its transverse meridian, to tend towards different foci, should be termed *Astigmism*, rather than "Astigmatism."

Lest I, who have no pretensions to scholarship, should appear to be unceremoniously criticising a term invented by such a scholar as the late Master of Trinity, I may observe that the change from Astigmatism to Astigmism had met with his approval, so far, at least, as etymology is concerned. Whether it be worth while now to alter a word the meaning of which is well recognized, is another question. After all, practical utility must be our guide in such matters; and a scientific term that is universally understood and easily remembered, need not be changed on mere grounds of etymological purism.

NOTE F.

Evidently, neither "Iridesis" nor "Iriddesis" can be the legitimate combination of ἶρις (ἶρίϑος) and δέσις. *Iridodesis* would be the natural form, but I believe we may fairly use a more euphonious compound, and say *Iriodesis.* I do not know of an instance where ἶρως occurs as the genitive of ἶρις, but that such a form did exist seems evident from the adjective ἰριώδης. This we find in Aristotle's Meteorologica, lib. iv, cap. 4: τό τε τοῦ λύχνου φῶς. . . . φαίνεται κύκλῳ καὶ ἰριῶϑες. In the same chapter the genitive ἶρίδος occurs.

TEST TYPES.

I HAVE here given specimens of some of the chief sizes of type as published by **Jæger**. ("Schrift-Scalen." 3d edition. 1860.) His scale consists of a regular gradation from 1 to 20; but it is not necessary to possess the entire series, and the sizes selected present varieties enough for practical purposes. I have copied **Jæger**'s types rather than **Snellen**'s, because the former have been so long in general use, and such frequent reference is made to them in reports of cases published during the last ten years. The principles on which **Snellen**'s letters are formed (see p. 11, *ante*), are no doubt more scientific than those which regulatd **Jæger**'s letters, and **Snellen**'s are to be preferred in cases where optical experiments are made upon educated and intelligent persons. But in dealing with hospital patients, it will be found that those of limited reading powers are sometimes puzzled by the unusual forms used by **Snellen**, and cannot read them fluently, even when quite able to distinguish the ordinary types they are accustomed to see in books and newspapers. Again, it is only with letters of a certain size that **Snellen** has carried into effect his own system, by drawing them on stone in accordance with the principles laid down at p. 11. Up to No. 3 inclusive, his letters are *printed* from ordinary thick-and-thin metallic types.

("Test Types for the Determination of the Acuteness of Vision." 3d edition. 1866.)

The style of type-cutting in England differs so much from that in use on the Continent, that it is quite impossible to insure absolute similarity, as to their thick and thin portions, between two letters of the same height, one of which has been printed from an English type, and the other from a foreign one. Among the test types printed for the use of our Hospital at Moorfields, some of the letters differ considerably from those distinguished by the same numbers in JÆGER's "Schrift-Scalen." In No. 20 especially the difference is very marked; the letters so numbered on our Hospital sheet being twice as thick as those of the same number by JÆGER, and nearly a fourth higher. The letters I have numbered 19 and 20 are exactly copied from JÆGER's original.

JÆGER's own examples of English are unfitted for use in this country in consequence of the unfortunate selection of the text. Much of it is a mere tissue of buffoonery, amusing enough where it first appeared, in the pages of a comic author, but in fact not a specimen of the English language at all.

The T-shaped diagram from DONDERS may serve to test an astigmatic eye. At a certain distance all the strokes will coalesce to form a single black figure. As the diagram is brought nearer to the eye, the vertical or the transverse strokes will be first separately seen, accordingly as the eye is astigmatic in its transverse or in its vertical meridian.

TEST TYPES:

Corresponding in size to the "Schrift-Scalen" of Prof. Jæger. (Third Edition, 1860.)

No. 1.

First, I was to prepare more land, for I had now seed enough to sow above an acre of ground. Before I did this, I had *
a week's work at least to make me a spade, which, when it was done, was but a sorry one indeed, and very heavy, and †
required double labour to work with it. However, I went through that, and sowed my seed in two large flat pieces of

No. 3.

ground, as near my house as I could find them to my mind, and fenced them in with *
a good hedge, the stakes of which were all cut of that wood which I had set before, †

No. 5.

and knew it would grow; so that in one year's time I knew I should *
have a quick or living hedge, that would want but little repair. This †

No. 6.

work was not so little as to take me up less than three *
months, because a great part of that time was of the wet †

No. 8.

season, when I could not go abroad. Within *
doors, that is when it rained and I could not go †

No. 10.

out, I found employment on the following *
occasions; always observing that, all the †

No. 12.

while I was at work, I diverted *
myself with talking to my parrot, †

No. 14.

teaching him to speak. *
I quickly taught him †

No. 15.

to know his own
name, and at last

No. 16.

**to speak it out
pretty loud 'Poll,'**

No. 18.

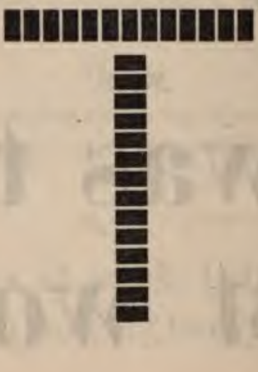
it was the
first word

No. 19.

I ever

No. 20.

heard



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